pH-Measure

accumet® excel

Channel 1

Last Standardizatio

Buffer Group :USA

> Touch standardize

Show Graph

Sample ID : —

User ID : Defau

Auto Buffer : ON

Auto Read : OFF

Standardize

Measure

Mode

Setup

Print

Log Data

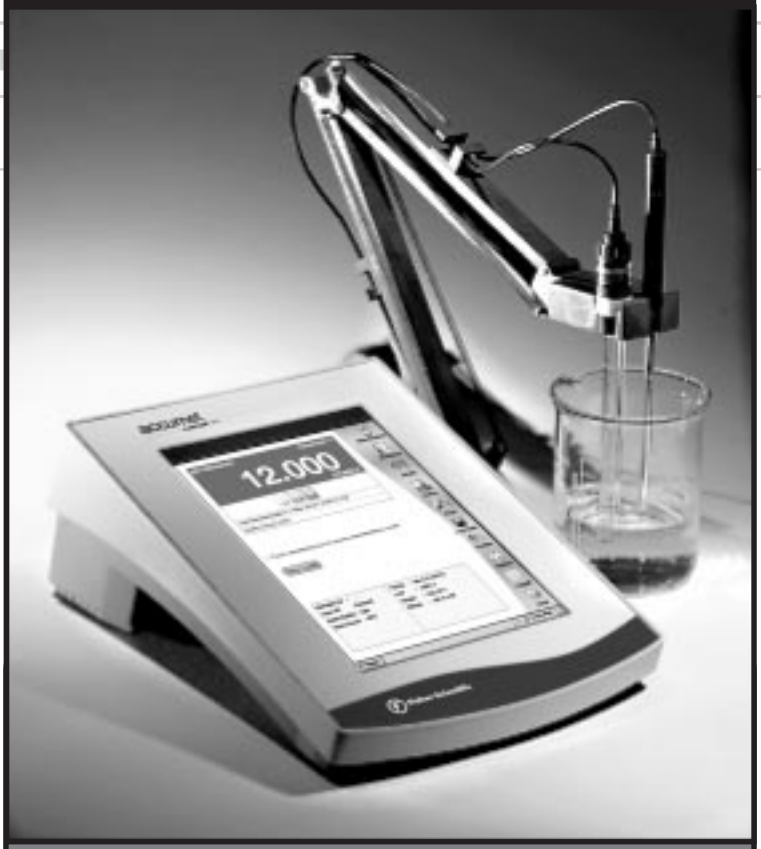
Profile

Home

Logoff

Help

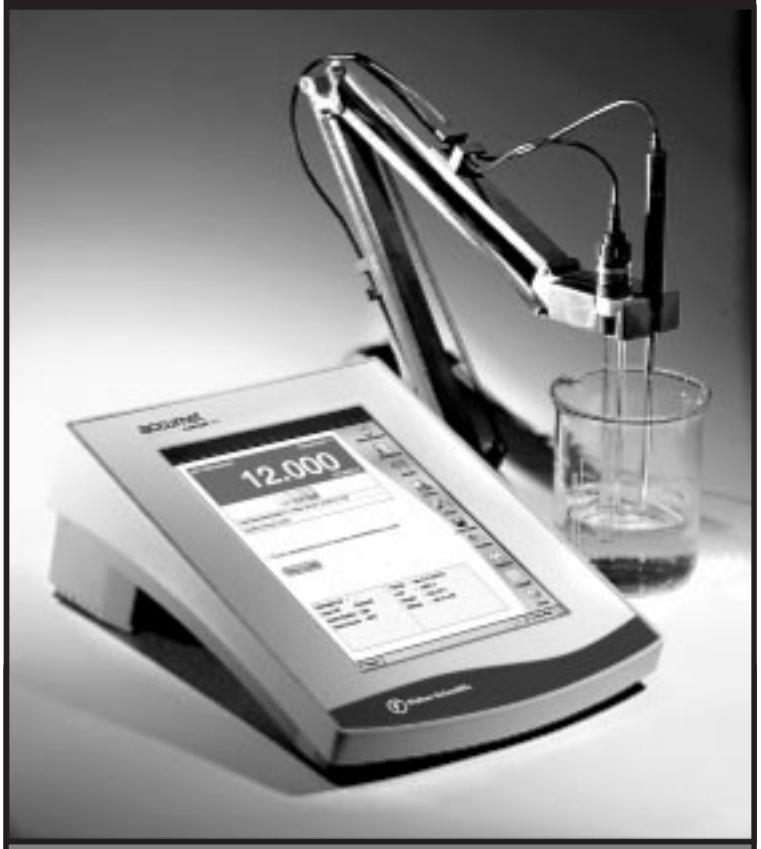
XL 15



USER Manual

Fisher Scientific

XL 15



USER Manual

accumet excel

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Fisher Scientific

Thank you for selecting a Fisher Scientific accumet pH meter. This manual describes the operation of the accumet XL15 meter. The state-of-the art meter that you have purchased runs on a Windows CE platform and has a similar framework of a pocket PC (or "Palm Pilot"). It is easy to operate and will guide you through the various functions by displaying easy to understand prompts. This operating manual should answer any questions that might arise in operating your meter; however, do not hesitate to call our accumet Technical Support Hotline at 1-888-358-4706, if you need any assistance.

This meter is designed to provide all the information necessary to guide you through the process of measuring pH or mV with a series of prompts on the screen. The accumet excel XL15 provides microprocessor precision in a compact benchtop design that is easy to use. One touch screen controls all procedures, letting you:

- Measure pH, absolute mV, relative mV or pH (FET)
- Select one of three sets of standard buffer groups
- Implement automatic buffer recognition
- Standardize with up to five standard or customer buffers
- Customize your display screen and operating parameters
- Assign operator and sample identification numbers
- Store 1000 data points per user in the meter's memory or transfer data to a computer or printer.
- Access extensive online help with just a touch a button

It all adds up to rapid, completely automatic, intuitive operation.

Useful tips will appear in this box throughout this manual

The following is a listing of what you should have received with your new accumet XL15 pH/mV meter.

Meter with kit includes

- meter
- power supply
- electrode arm support bracket
- electrode arm
- electrode (13-620-130)
- ATC probe (13-620-19)
- manual and literature

Meter only includes

- meter
- power supply
- electrode arm support bracket
- manual and literature

If any of these items are missing, please contact the accumet Technical Support Hotline at 1-888-358-4706. Accessory Conductivity Probes and Ion Selective Electrodes are available and can be ordered by calling Fisher Customer Service at 800/766-7000.

Display

	640x480 digit LCD
screen size	4 1/2” x 6”
menu options	extensive
help screens	extensive
configurable display	yes
keypad controls	context specific touchscreen

Memory

	1000 data pts
internal diagnostics	yes
programmable data storage	store on stable, time, manual
programmable data output	output on stable, time, manual
print interval	1 to 86400 sec
programmable alarm	yes

pH Mode

range	-2.000 to 20.000
resolution	0.1/0.01/0.001
relative accuracy	± 0.002
automatic buffer recognition	yes
manual buffer recognition	yes
calibration points	5
auto lock	yes
FET	yes

mV Mode

range	± 2000.0
resolution	0.1
accuracy	± 0.2

Temperature Mode

range	-5.0 to +105.0 °C
resolution	0.1 °C
accuracy	± 0.2 °C

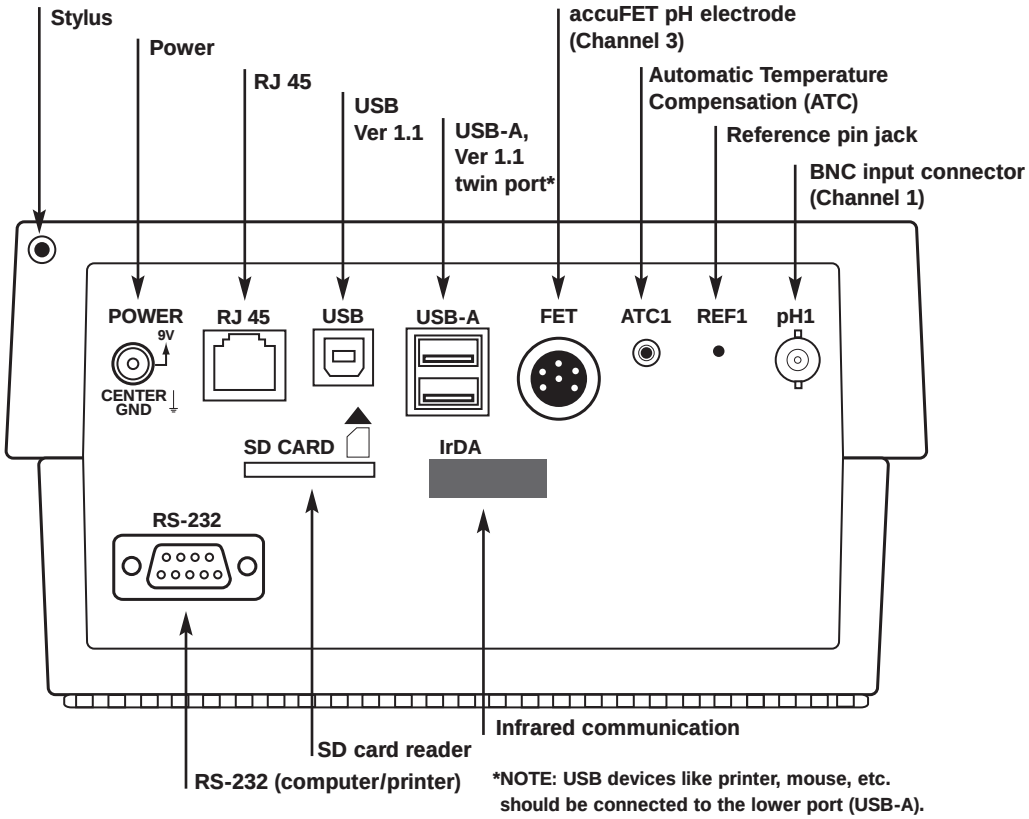
General

inputs/outputs	BNC, Pin, ATC, RS232, DIN (for FET)
electrical requirements	115 V/60 Hz, 230 V/50 Hz
output from PSU	9VDC, 3.3A center negative
line voltage tolerance	± 10%
input impedance	>10 12 ohms
meter size	6.75"x9.25"x3.5"
meter weight	2.8 lb.

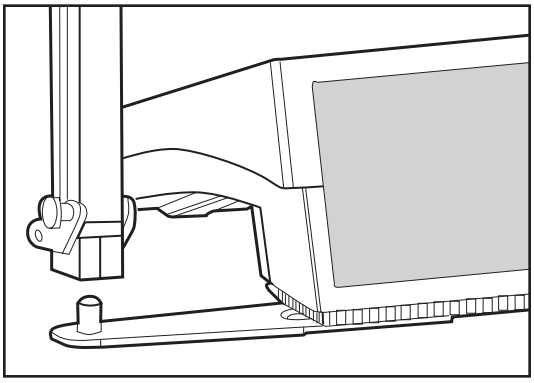
Operating Conditions

operating temperature	5-45 °C
operation humidity	5-80 % noncondensing
maximum operating altitude	2000m
installation category	II
Pollution category degree	2

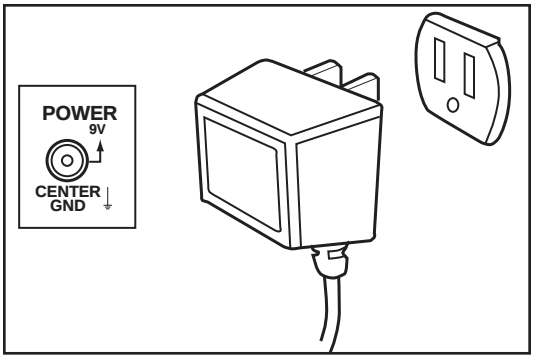
1 Review the layout and arrangement of the rear connector panel.



2 Connect the electrode arm to the base.



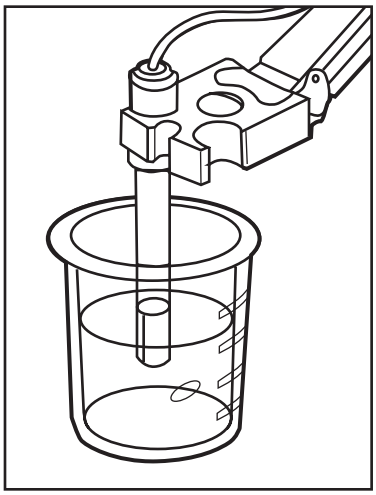
3 Connect the power cable to the rear connector panel power jack and to a power source.

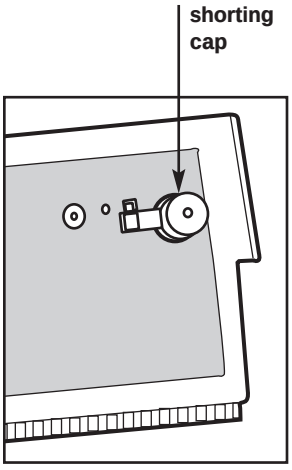


This meter allows you to use two types of pH electrodes: the conventional glass pH electrode and the AccuFET field effect transistor (FET) pH electrode.

1

Carefully remove the protective cover from the end of the electrode. Before first using your glass pH electrode, or whenever the electrode is dry, soak it 2-4 hours in an electrode storage solution, pH 4 Buffer, or KCl solution.





Do not discard the BNC shorting cap.

2

Remove the shorting cap on BNC connector. Connect the **combination pH electrode** by plugging it into the BNC input connector (twisting to lock in place).

If a combination electrode isn't used, connect the **indicating pH electrode** into the BNC input connector. Plug the **reference electrode** into the reference pin jack. Also, install the **ATC probe** into the ATC jack.

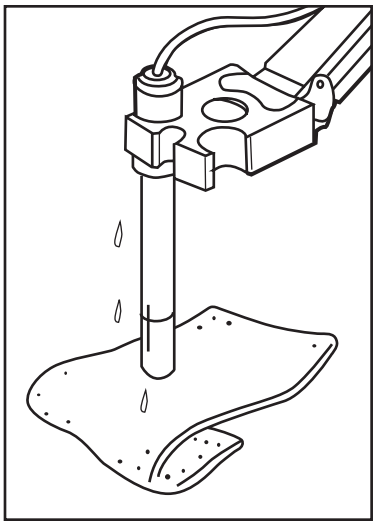
Note: Be sure to connect all probes to the appropriate **channel connectors** (for example: Input 1, Ref 1 and ATC1).

Option: Connect the optional **AccuFET electrode** by plugging it into the FET jack on the back meter panel. Allow the AccuFET to warm up five minutes before use.

If both a conventional electrode and an AccuFET electrode are connected to the meter, do not put them in a solution together because you will get inaccurate measurements.

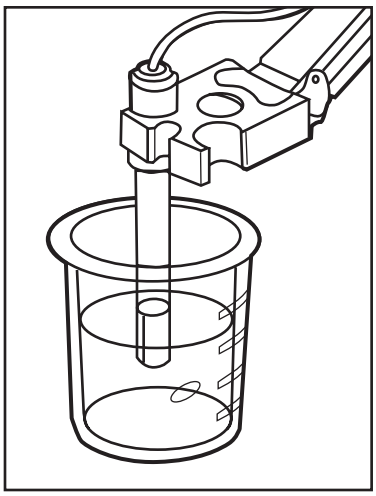
3

Rinse and blot-dry (don't wipe) electrodes between each measurement. Rinse electrodes with distilled or deionized water, or a portion of the next solution to be measured.



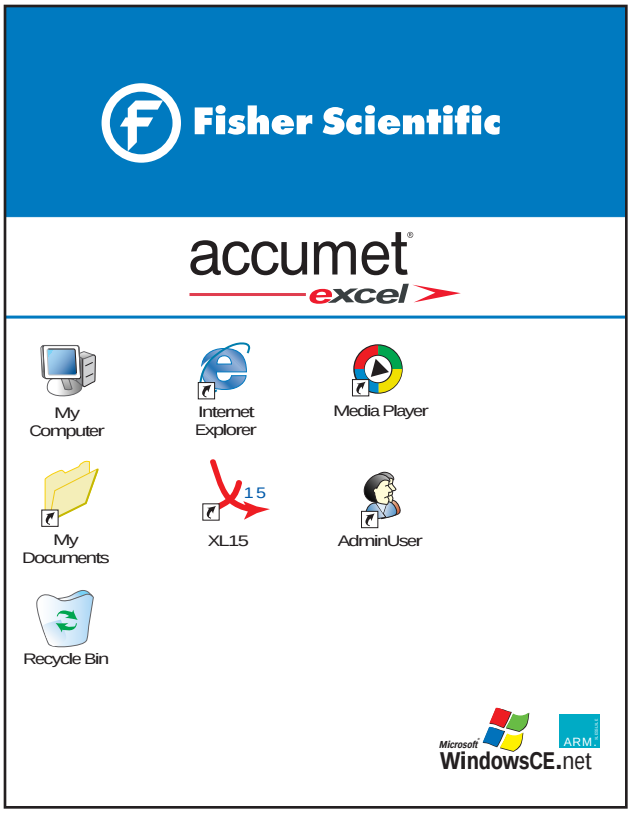
4

Between measurements, store conventional pH electrodes in electrode storage solution, pH 4 buffer, or KCl solution. Always leave the filling hole of liquid filled combination electrodes open. Refill when the level of solution gets below the manufacturer's recommended level.

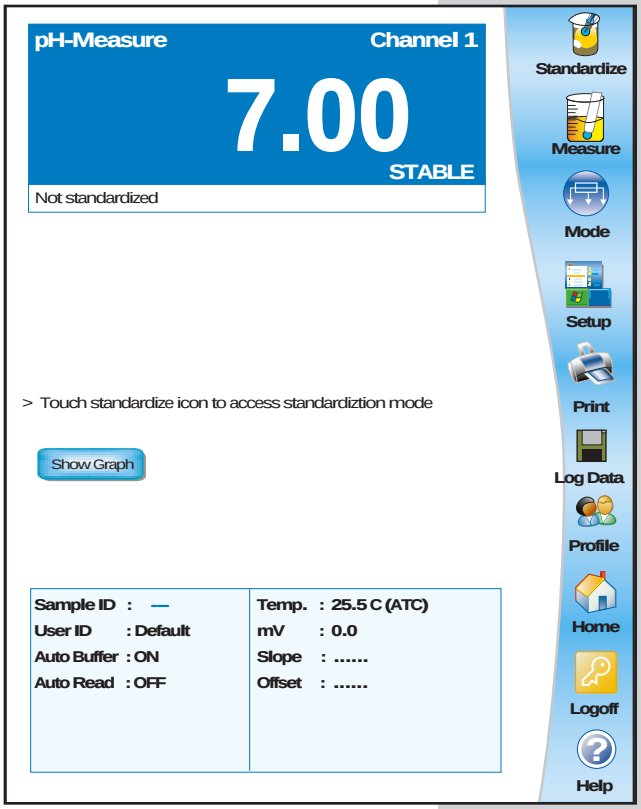


Proper electrode care is fundamental to obtaining reliable pH measurements. Improper care of the electrode may cause the meter reading to drift, respond slowly, or produce erroneous readings. For this reason, the electrode should always be conditioned and used in accordance with manufacturer's instructions.

When the meter is turned on it first goes though self test, displays the FISHER Catalog cover, briefly displays the desktop screen (**Home**) before loading the XL15 program which results in the display of the measurement screen.



Desktop screen(Home)



pH measurement screen

The new accumet XL15 benchtop pH meter operates with a state-of-the-art touch screen. The touch screen makes this the easiest meter on the market to operate and care for. When the meter is first plugged in, the meter runs a self-test and takes you to the pH measurement screen. Touch any icon to access the functions of the meter. Your XL15 meter also includes a stylus that you can use to tap on your screen. The stylus easily stores inside the back panel of the meter.

The buttons on the right side of the screen control all of the functions of the meter. A light touch on the screen is all that you need to access the various functions. Once you touch a button you will get an audible tone; **the screen will not change until you lift your finger**.

This design prevents rapid uncontrolled scrolling through the various function screens. Function buttons and options change from screen to screen. Easy to understand prompts guide you through the operation of the meter in the selected mode. If you are ever in doubt about what to do, just touch **Help** on the bottom right corner of the screen for detailed information about that screen.

The touch screen is made of a durable polyester material that is chemically resistant. Maintenance is simple with this meter. To clean the screen you just need to wipe it with a damp cloth and dry it with a clean dry towel. For additional information, see Cleaning and Troubleshooting sections of the manual.

Your XL15 Meter comes with a stylus that you should use to tap on your screen. The stylus easily stores inside the back panel of the meter.

You can perform two basic actions using the stylus:

Tap
Lightly touch the screen to select or open an item. Lift the stylus after you tap an item. Tapping is equivalent to clicking an item with the mouse on your personal computer. **Note:** Some program items require a double tap to select or launch. Double tap on the icons from the Desktop (**Home**) page and single click in the XL15 application

Drag
Place the point of the stylus on the screen and drag an item across the screen without lifting the stylus until you have completed the selection. Dragging is equivalent to dragging with the left mouse button pressed on your personal computer .

CAUTION: To prevent damage to your XL15 screen, never use any device other than the stylus that comes with the meter or an approved replacement to tap on the screen. Order extra or replacements if you lose or break your stylus.

Setting the Time

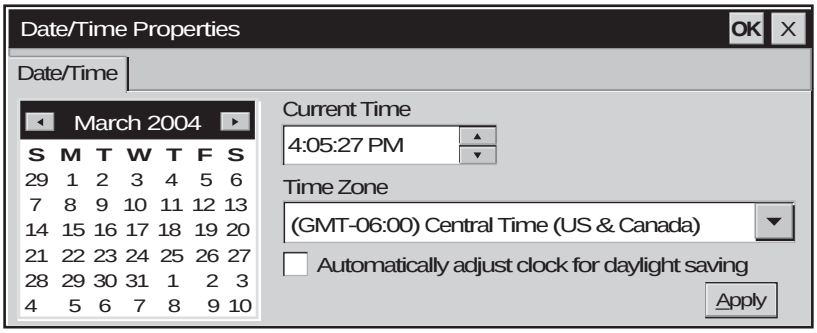
1. From the **HOME** screen tap the bottom left of the screen to access the Start menu. Tap **Start > Settings > Control Panel**. This launches the **Control Panel** screen.
2. Double tap **Date/Time** icon. This launches the **Date/Time Properties** window.
3. Tap the time-zone down arrow, and select the appropriate time zone.
4. Tap the hour, minutes, or seconds. Use up and down arrows to adjust.
5. Tap AM or PM. Use up and down arrow to select.
6. Tap **Apply** button.
7. Tap **OK** to save the time.

Setting the Date

1. From the **HOME** screen tap the bottom left of the screen to access the Start menu. Tap **Start > Settings > Control Panel**. This launches the **Control Panel** screen.
2. Double tap **Date/Time** icon. This launches the **Date/Time Properties** window.
3. Tap the left or right arrow to select a month and year.
4. Tap a day.
5. Tap **Apply** button.
6. Tap **OK** to save the time.

You need to reset your time zone, time, and date if:

- The time changes or you are traveling to a different time zone.


Date/Time Properties
OK
X
Date/Time
March 2004
S M T W T F S
29 1 2 3 4 5 6
7 8 9 10 11 12 13
14 15 16 17 18 19 20
21 22 23 24 25 26 27
28 29 30 31 1 2 3
4 5 6 7 8 9 10
Current Time
4:05:27 PM
Time Zone
(GMT-06:00) Central Time (US & Canada)
Automatically adjust clock for daylight saving
Apply

The time on the meter can be synchronized with your personal computer through Microsoft® "Active sync".

Using the On-Screen Keyboard

Use the stylus to tap letters, numbers, and symbols on the on-screen keyboard to enter typed text directly onto the screen.

1. From any application, screen tap the bottom right of the screen to access the input panel. Tap the **Pencil/Keyboard** icon (see below). A pop-up menu will appear.
2. Tap **LargeKB** to display a large keyboard with all function keys.
   Tap **keyboard** for a basic function alphanumeric keyboard.
3. Tap desired letters, numbers and symbols on the keyboard. Hit the enter key.
4. To remove keyboard, tap on **Pencil** icon. The pop-up menu will appear. Tap **Hide Input Panel** to remove keyboard.

To see symbols, tap the **Shift** key.

Expansion Cards

You can expand the memory and connectivity of your XL15 meter.

Use optional expansion cards for:

- Expanding the memory of your XL15 meter
- Viewing the content of memory cards

> Expansion cards must be purchased separately and are not included with your XL15 meter

Installing an Expansion Card

To install a Secure Digital (SD) card into an expansion slot on the XL15 meter:

1. Locate the slot on the top of XL15 meter.
2. Remove the protective plastic card.
3. Insert the expansion card into the expansion slot and push the connection edge of the card firmly into the expansion slot.

> If your expansion card is not recognized, follow the card manufacturer's instructions to install it.

Removing a Secure Digital (SD) Expansion Card

1. Close all applications that are using the expansion card.
2. Remove a card from the Secure Digital expansion slot by **slightly pushing down on the card** to unlock it.
3. When the card disengages and pops up, pull it from the expansion slot.

> **CAUTION:** SD cards must first be unlocked before removal.

Viewing the Content of Memory Cards

Use File Explorer to view the files that are located on your optional Secure Digital card.

1. From the **Start** menu, tap **Programs > File Explorer**.
2. Tap the root directory of **My Device**, and select the Storage Card folder (SDIO) to see a list of files and folders.

Entering an Internet Address

With Pocket Internet Explorer and a connection to the Internet, you can view Web sites on your XL15 meter by typing an address or Universal Resource Locator (URL) in the **Address** bar. Web sites that use HTML 4.0, DHTML, animated GIF images, and Java applets may not work correctly in Pocket Internet Explorer without additional software.

To enter an Internet address (URL) on your XL15 meter :

1. From the **Start** menu, tap **Programs > Internet Explorer > Address Bar**. If the Address Bar is not visible, tap the **View** tab **> Address Bar** to turn it on. You may also double tap the **Internet Explorer** icon on the **Home** screen to launch Internet Explorer.
2. Enter the Internet address (URL) in the Address bar using the on-screen keyboard.
3. Tap the **Go** icon.

Using a Favorites List

With Pocket Internet Explorer and a connection to the Internet, you can view Web sites on your XL15 meter by selecting one from your Favorites list.

To select a Web site from your **Favorites** list:

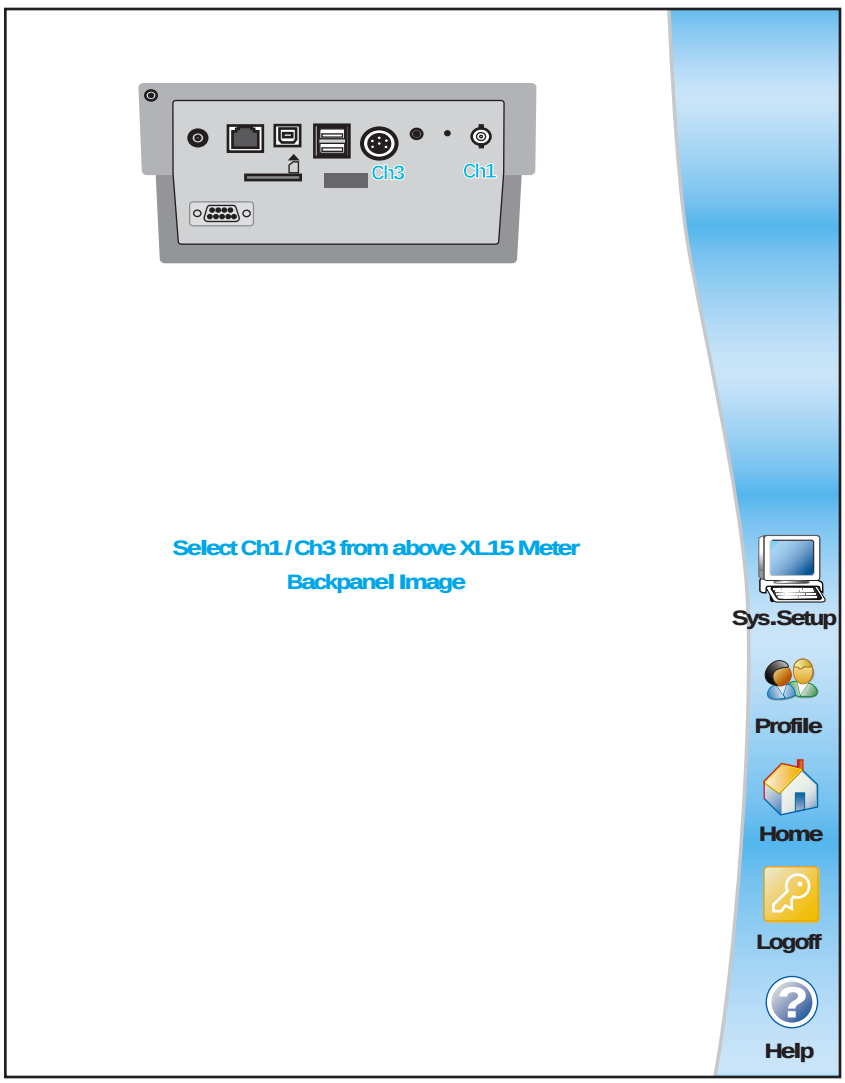
1. From the Start menu, tap **Internet Explorer**.
2. Tap the **Favorites** icon and the Web site you want to view.

The XL15 is a multi-channel meter. With this meter you can switch from channel 1 to channel 3. You cannot view both channels at the same time. The setup parameters for each screen are independent from one another.

Choosing a channel

1. Touch **Ch1** or **Ch3** on the main screen to select a **channel.**

If you are in any measurement mode, touch **Mode** until you access the main screen.



The touch screen of your XL15 bench meter has “buttons” along the right side of the screen that are common to many of the screens. The following indicates the function of these common buttons.

Standardize

The **Standardize** button accesses the standardization screen from the various measure modes and initiates standardization of the meter once the standardization screen is accessed.

Measure

The **Measure** button directs the meter to measure your sample when in the Auto Read function of the pH or pH (FET) modes.

Mode

The **Mode** button allows you to switch between the various operations of the meter—pH, mV and pH (FET)

Setup

The **Setup** button will access the setup screens of the measuring mode that you are currently using.

Print

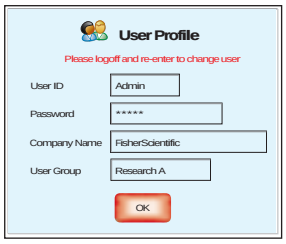
The **Print** button will send information to the output device that you are connected to your meter. The output device can be a printer or data logger. Touching the **Print** button will also send data to the data storage center of the meter if a sample ID# has been assigned to your sample.

Log Data

The **Log Data** button sends data to the data storage center of the meter if a sample ID# has been assigned to your sample.

Profile

The **Profile** button lets you view your profile (User ID, Password, Company Name, User Group) You can change only your profile and not of any other user. You can change to a different user only if you are the default user of the system.



Home

The **Home** button accesses the Windows CE desktop. The XL15 application does not shut down if Home is pressed and the current user remains logged in. Double tap on the XL15 icon to return to the previous screen before the Home button was pressed.

Logoff

The **Logoff** button allows you to logoff the current user from the XL15 application. The XL15 application shuts down returning to the Win CE desktop. When you re-start the application, you go to the main screen of the application. The second time you are logged in as the default user of the system.

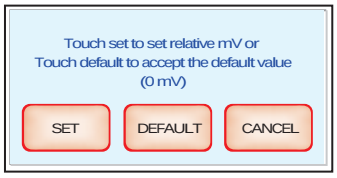
Help

The **Help** button allows you to access helpful information on any screen. Touching the Help button gives you information about the current screen. This information will include step-by-step instructions for operating the meter from the current screen and possible applications information for that screen.

Sys.Setup

The **Sys.Setup** button allow you to turn on or off the beep status. This is the audible beep that sounds each time any button is touched. The Sys.Setup button is only accessible in the Mode screen.

The **rel mV** button returns the meter into the relative millivolt mode when in the absolute mV mode. When this mode is activated, a window will appear asking you to set a relative mV value or accept the default value of 0 mV. This feature may assist the user to standardize certain analytical and monitoring activities such as titration.



The **abs mV** button returns the meter to absolute millivolt mode when the meter is in the relative mV mode. This button only appears when the meter is in the relative mV mode

The following buttons appear in the pH and pH (FET) standardization screens:

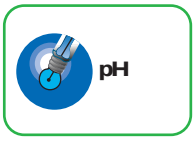
The **Confirm** button accepts current value of the buffer being standardized. This button only appears in the pH and pH (FET) standardization screens.

The **Clear** button clears all previous standardization points. This button only appears in the pH and pH (FET) standardization screens.

The **Cancel** button cancels current standardization and returns to the pH measurement screen. This button only appears in the pH and pH (FET) standardization screens.

The **Temp Std** button allow you to check the accuracy of your temperature probe and standardize to an accurate thermometer.

*The following buttons appear in the mode screen after **Ch1** or **Ch3** is selected:*

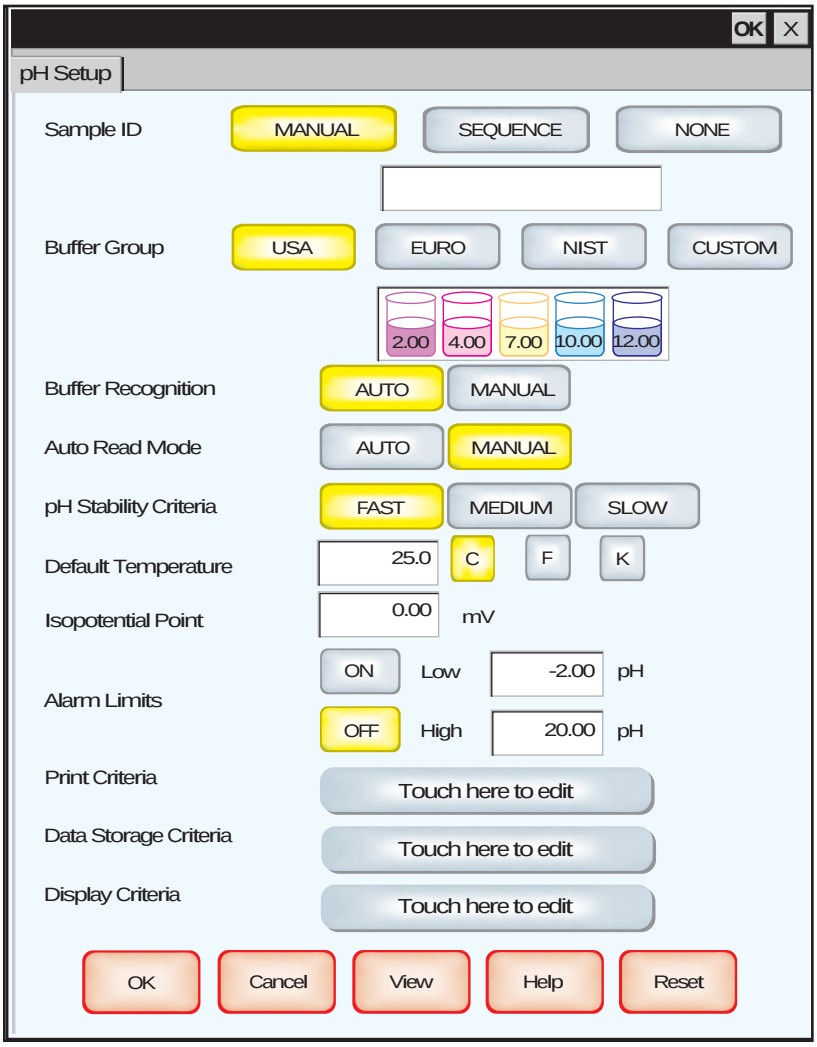


The **pH** mode button allows you to switch to the various pH operations of the meter.

The **pH (FET)** mode button allows you to switch to the various pH (FET) operations of the meter.

The **mV** mode button allows you to switch to the various mV operations of the meter.

The pH Setup screen present many options to control the operating parameters of the meter. The meter is factory set with regard to these options, and is ready for use under most circumstances (see appendix page 59 for default settings). The operating parameters of the pH mode can be set and controlled from the pH setup screen. The pH Setup section will guide you through the various options available in the pH setup mode.



Function Buttons on pH Setup Screen

Touch **OK** to confirm pH Setup and return to the pH Measure screen.

Touch **Cancel** to exit and return to the pH Measure screen without confirming pH Setup.

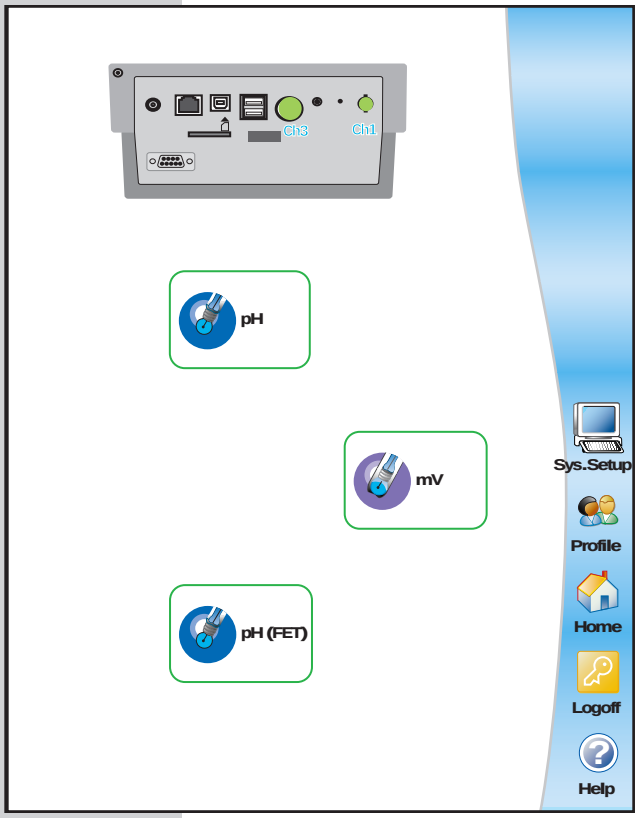
Touch **View** to view all pH data points stored in memory. See pages 32-33 for details.

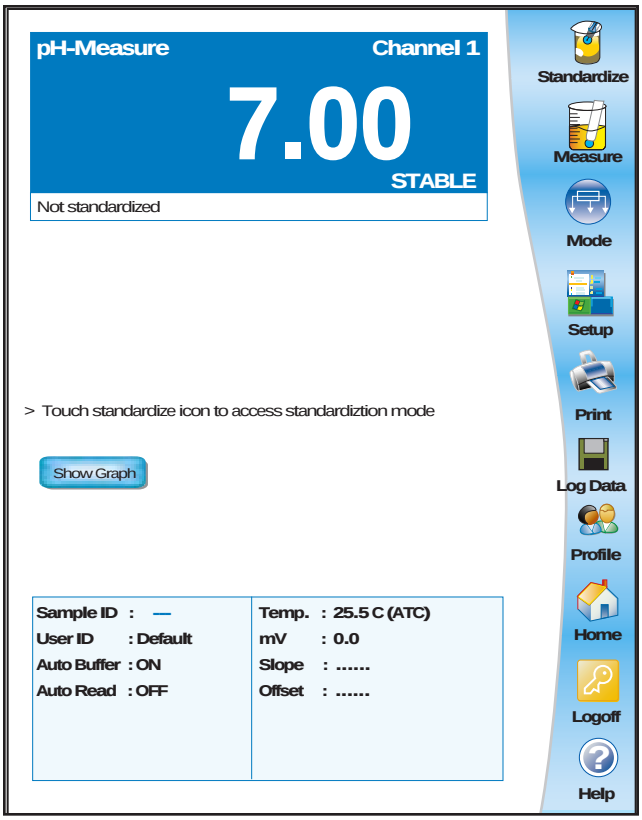
When you touch the **Help** button, information about the current screen appears. This information includes step-by-step instructions for operating the meter from the current screen and possible applications information for that screen.

Touch **Reset** to reset all pH Setup Criteria to the factory default.

There is one way to access the pH Setup screen.

1. Make sure meter is in pH Measure mode. Touch **pH** on the mode screen to access the pH mode Measure screen
2. Touch **Setup** option on the pH Measure screen





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Whenever this option is active, each time you touch **Print** or **Log Data** on the pH Measure screen, the pH (or pH FET) value along with date/time/channel and the sample ID will be sent to data storage. You can manually enter an alphanumeric identification number of 10 characters for any sample or you can have the meter sequentially number your samples beginning at the number of your choice. You can also choose to deactivate the sample ID.

To set sample ID — Manual:

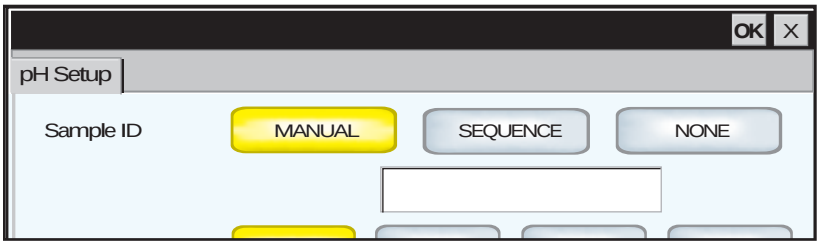
1. Touch **Manual** for manual Sample ID entry
2. The current ID is displayed on the screen
3. Use the alphanumeric keypad on the screen to enter the desired Sample ID. The **BS** key will allow you to backspace to remove a character that was incorrectly entered.
4. Touch **Enter** to accept current Sample ID and return to the pH (or pH FET) Setup screen.

To set sample ID — Sequential

1. Touch **Sequential** for sequential Sample ID entry
2. The current ID is displayed on the screen
3. Use the numeric keypad on the screen to enter the desired Sample ID number that you would like your sequential Sample ID assignment to begin with. Every time you touch **Print** or **Log Data** on the pH Measure screen, the Sample ID will increase by 1. The **BS** key will allow you to backspace to remove a character that was incorrectly entered.
4. Touch **Enter** to accept the first sequential Sample ID and return to the pH (pH FET) Setup screen.

To deactivate the sample ID assignment — None

1. Touch **None** to deactivate the sample ID assignment

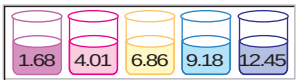


This setup option allows you to select from 3 different buffer groups, for auto buffer recognition. Or you can create a custom group of buffers for auto buffer recognition by touching custom.

The 3 existing buffer groups are :

USA buffers: 2.00, 4.00, 7.00, 10.00, 12.00

European buffers: 1.00, 3.00, 6.00, 8.00, 10.00, 13.00



NIST buffers: 1.68, 4, 6.86, 9.18, 12.45

To select buffer group

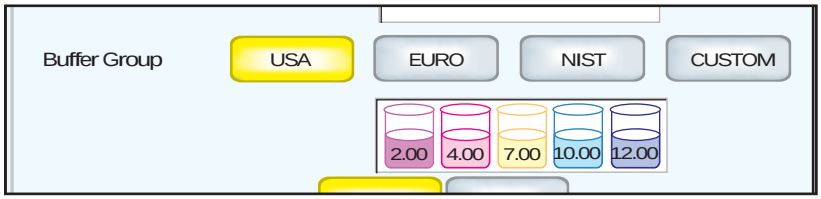
1. Touch **USA**, **EURO**, **NIST** or **CUSTOM** from the setup screen to select a buffer group.

To set Custom pH buffer group

This option allows you to create a custom buffer group of up to 5 buffers (2 buffer minimum) to be used for auto buffer recognition. To obtain optimal results, it is important to maintain at least 1 pH unit between selected buffers in the custom group.

1. Touch **CUSTOM** on the setup screen to select a custom buffer. This will display a set of 5 custom beakers each initialized to zero.

2. Touch one of the beakers to display the numeric keypad.
3. Enter a value for the custom pH buffer that you want set in your custom buffer set.
4. Press **Enter** in the keypad to accept the value.
5. Repeat steps ***2*** through ***4*** until all 5 custom buffer beakers are populated with desired values.
6. To modify the value entered, touch the particular beaker and key in the new value using keypad.
7. To clear all custom buffer values, touch **CLEAR**.



This option allows you to select Automatic buffer recognition or manual buffer recognition when standardizing. With the automatic buffer recognition activated, the meter will automatically recognize the buffers from the chosen buffer group and accept them when the meter recognizes the reading as stable. When in the Manual buffer recognition mode, you must enter the buffer value during the standardization procedure. The meter will accept the manually entered buffer when you recognize that the measurement is stable. During the standardization procedure, you may accept the buffer value before the meter recognizes it as stable by touching the **Standardization** button.

To select Buffer Recognition

1. Touch **MANUAL** or **AUTO** to choose the method of buffer selection

You can use this meter when the Auto Read function is active or when it is inactive. When the Auto Read function is active, the meter will lock onto a reading when the meter recognizes it as stable. The meter will not deviate from this reading until Measure is touched. If the Auto Read function is inactive, then the meter will continuously monitor the pH of the sample and the Measure screen display will indicate any fluctuation in the sample pH.

To select Auto Read Mode

1. Touch **MANUAL** or **AUTO** to choose the desired read mode.

This setup screen allows you to determine how quickly the meter will respond to electrode drift. There are 3 speed settings: fast, medium and slow

To set pH Stability Criteria

1. Touch **FAST**, **MEDIUM**, **SLOW** to choose the desired stability criteria.

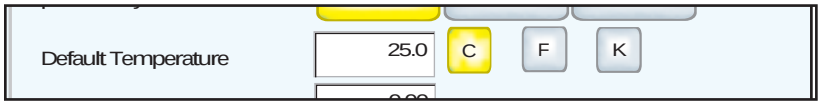
Stability criteria are more stringent at the slower setting. Therefore, if the highest precision is required, then a slow setting would be desired. The default setting is the **FAST** and this should be adequate for the majority of applications. without making any changes.

It is a well known fact that pH is a temperature dependent measurement. The factory default setting is 25°C. If you are taking the pH of a solution that is not 25°C and you are not using an Automatic Temperature Compensation (ATC) probe, then you should enter the temperature value of that solution in order to get the correct pH value. The current default temperature setting will be displayed on the screen.

The default temperature can be set from -5°C to 105°C.

To set Default Temperature

1. Select temperature units by touching the appropriate unit button: **C** (Celsius), **F** (Fahrenheit) or **K** (Kelvin)
2. Touch the **Default Temperature box** and use the numeric keypad to enter the desired default temperature (-5°C to 105°C).
3. Press **Enter** in the keypad to return to pH (pH FET) Setup screen



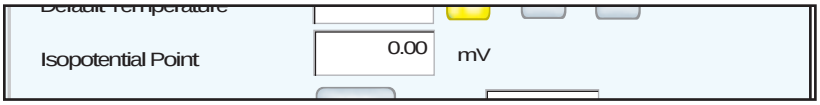
The use of an ATC probe provides a measured temperature value to the meter and will override any value entered in the default temperature screen. This measured value will be used by the meter to make pH calculations.

The isopotential point is the millivolt reading for an electrode at which temperature has no effect on the measurement. pH electrodes are constructed so that the isopotential point is theoretically zero millivolts. This is very close to a pH of 7. Most pH electrodes do not achieve this value precisely. However they are close enough so that it is not usually necessary to use an isopotential point other than zero. The true isopotential point of any given electrode must be determined experimentally.
(See Appendix: Determining Isopotential Points Experimentally, page 58)

The isopotential point can be set from -100 to +100

To set Isopotential Point

1. Touch the **Isopotential Point box** and use the numeric keypad to enter the desired mV setting for the new isopotential point.
2. Touch **Enter** to accept this value and return to pH (pH FET) Setup screen.

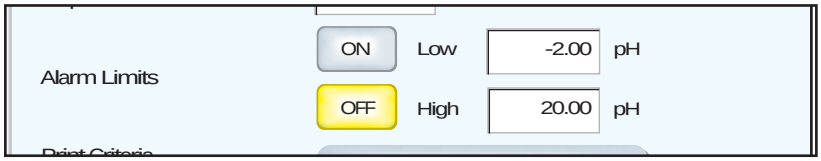


This option allows you to set alarm limits for the pH measuring mode. If the pH value of the measurement is outside of the boundaries set by the minimum and maximum limits, a visual warning will appear to let you know that your sample measurement was outside of the set limits.

The Alarm Limit can be set from -2 pH to 20 pH

To set Alarm Limits

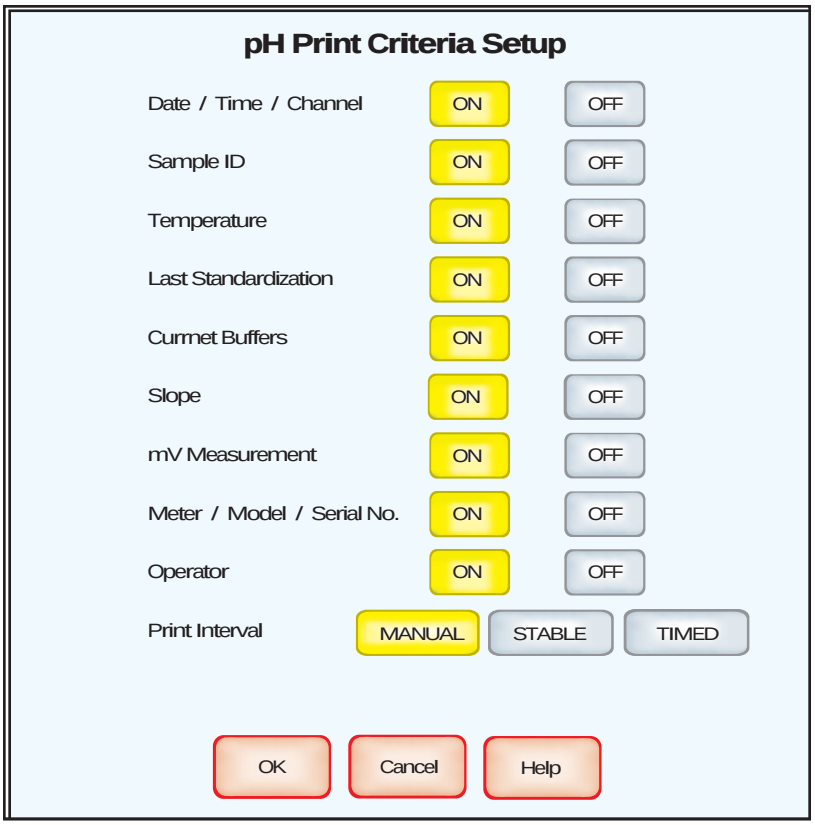
1. Touch **ON** or **OFF** to set the status of the alarm of pH (pH FET) mode
2. Touch the **Low box** and use keypad to enter the new limit values.
3. Touch **Enter** on the keypad to accept this limit and return to the pH (pH FET) Setup screen.
4. Touch the **High box** and use keypad to enter the new limit values.
5. Touch **Enter** on the keypad to accept this limit and return to the pH (pH FET) Setup screen.



This screen allows you to select which criteria are printed with the measurement when you print the data or send it to a computer. The status of the current print criteria is displayed on the screen. The criteria option is active if ***ON*** appears to the right of the option. It is inactive if ***OFF*** appears to the right of the option. Any active criteria will be printed on demand.

To set Print Criteria

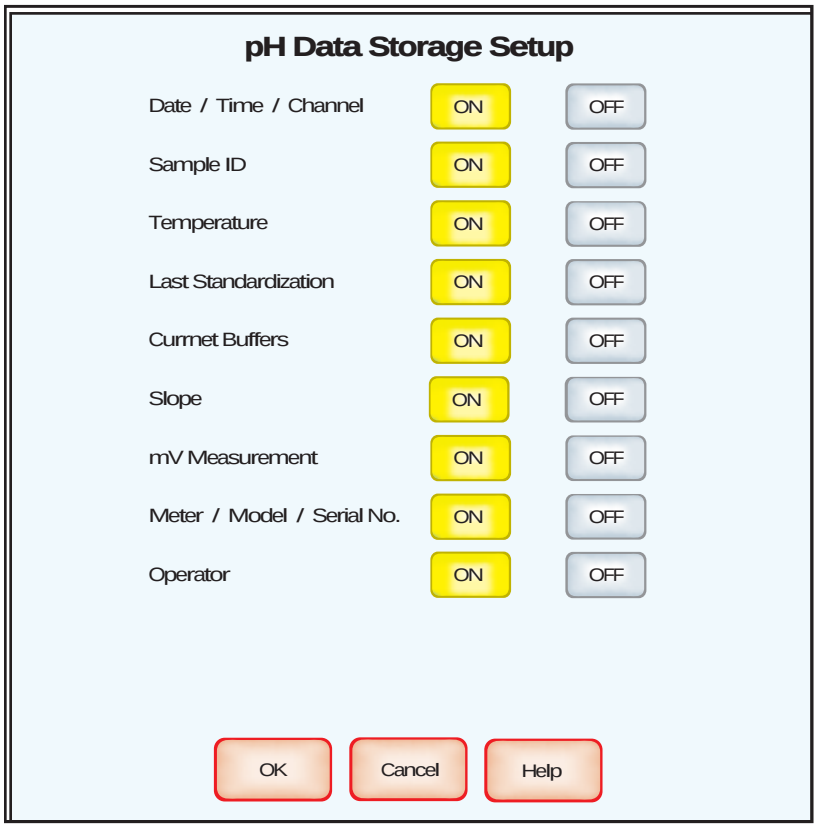
1. Touch the **Touch here to edit** button next to the Print Criteria to access the pH Print Criteria Setup screen.
2. Touch **ON** or **OFF** to change the status of a criteria you want to modify.
3. Repeat step **2** for all the remaining criteria except **Print Interval**.
4. For Print Interval, touch **MANUAL** to print pH data only when the **Print** button is pushed, touch **STABLE** to automatically print pH data when pH reading is stable, or touch **TIMED** to set a specific timed interval in seconds to print pH data.
5. Touch **OK** button to accept the changes of the entire group of print criteria and return to the pH (pH FET) Setup screen.



This screen allows you to select which criteria are stored in the data logger with the measurement when you store the data .The status of the current data storage criteria is displayed on the screen. The criteria option is active if ***ON*** appears to the right of the option. It is inactive if ***OFF*** appears to the right of the option. Any active criteria will be stored on demand.

To set Data Storage Criteria

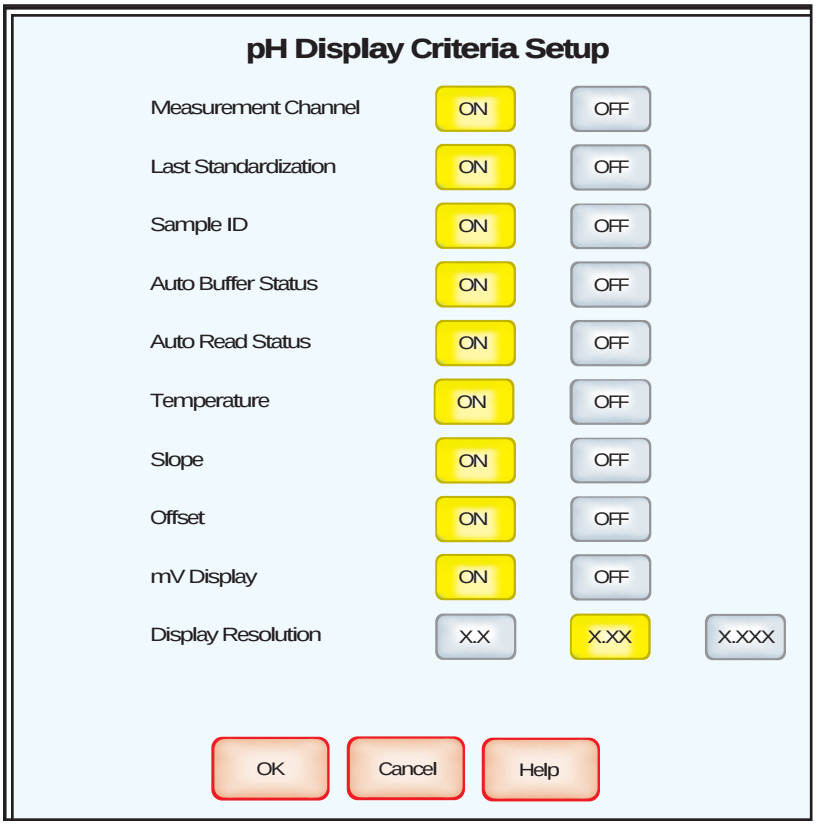
1. Touch the **Touch here to edit** button next to the Data Storage Criteria to access the pH Data Storage Setup screen.
2. Touch **ON** or **OFF** to change the status of a criteria you want to modify.
3. Repeat step **1** for all the remaining criteria.
4. Touch **OK** button to accept the changes of the entire group of data storage criteria and return to the pH (pH FET) Setup screen.



This screen allows you to choose what information you would like to be displayed on the pH Measure screen, particularly the information contained in the data box at the bottom of the Measurement screen. The status of the current display criteria is displayed on the screen. The criteria option is active if ***ON*** appears to the right of the option. It is inactive if ***OFF*** appears to the right of the option.

To set Display Criteria

1. Touch the **Touch here to edit** button next to the Display Criteria to access the pH Display Criteria Setup screen.
2. Touch **ON** or **OFF** to change the status of a criteria you want to modify.
3. Repeat step **2** for all the remaining criteria except **Display Resolution**.
4. For Display Resolution, touch **X.X** to display pH with one decimal place, touch **X.XX** to display pH with two decimal places, or touch **X.XXX** to display pH with three decimal places.
3. Touch **OK** button to accept the changes of the entire group of display criteria and return to the pH (pH FET) Setup screen.



The XL15 has a memory capacity to store up to 1000 data points. The View Stored Data screen allows you to sort and look at specific data points stored in the meter based on the meters memory capacity. The stored data can be sorted by any of the parameters available in the screen header.

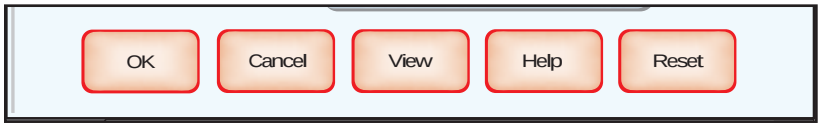
The meter stores pH or pH (FET) data under the following parameters:

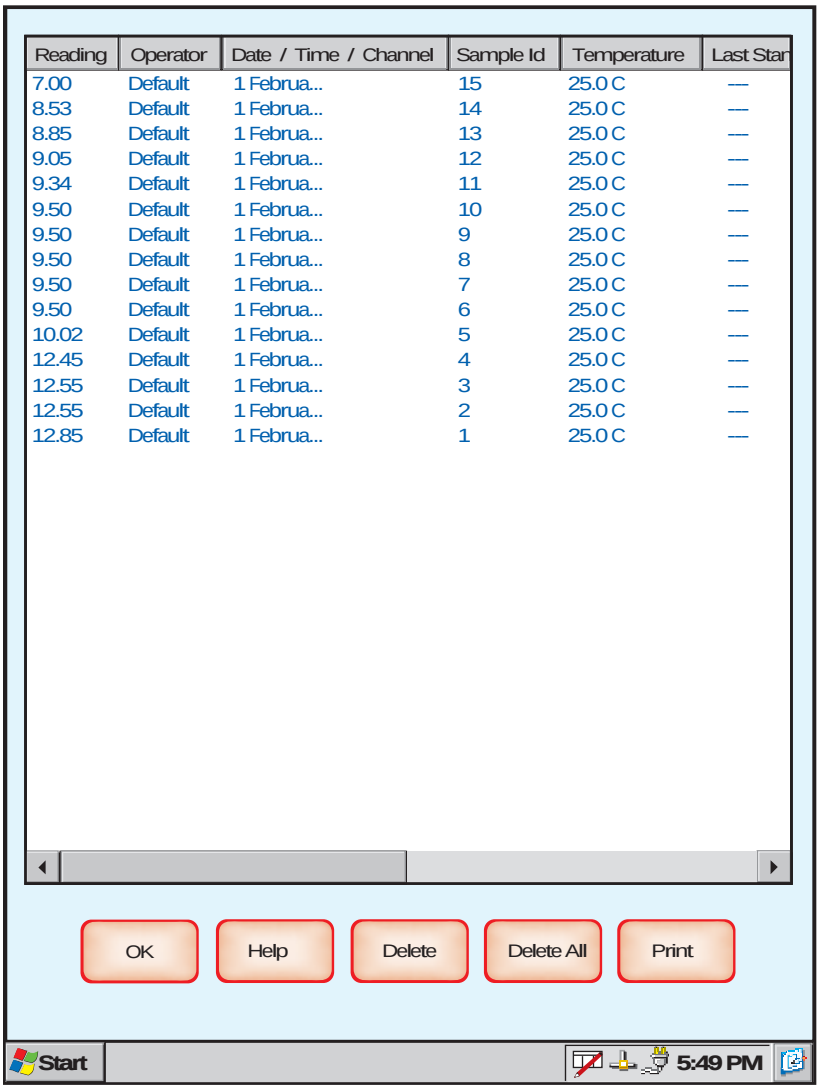
- Reading
- Operator
- Date / Time / Channel
- Sample Id
- Temperature
- Last Standardizations
- Current Buffers
- Slope
- mV Measurement
- Meter Model Serial No.

To View Stored Data

1. Touch the **View** button in the pH Setup screen

You can only log 1000 data points at a time. To clear space for new data points, you have to delete the same number of old data points as you want to add new data points.




Reading
Operator
Date / Time / Channel
Sample Id
Temperature
Last Stan
7.00 Default 1 Februa... 15 25.0 C —
8.53 Default 1 Februa... 14 25.0 C —
8.85 Default 1 Februa... 13 25.0 C —
9.05 Default 1 Februa... 12 25.0 C —
9.34 Default 1 Februa... 11 25.0 C —
9.50 Default 1 Februa... 10 25.0 C —
9.50 Default 1 Februa... 9 25.0 C —
9.50 Default 1 Februa... 8 25.0 C —
9.50 Default 1 Februa... 7 25.0 C —
9.50 Default 1 Februa... 6 25.0 C —
10.02 Default 1 Februa... 5 25.0 C —
12.45 Default 1 Februa... 4 25.0 C —
12.55 Default 1 Februa... 3 25.0 C —
12.55 Default 1 Februa... 2 25.0 C —
12.85 Default 1 Februa... 1 25.0 C —
OK
Help
Delete
Delete All
Print
Start
5:49 PM

Function buttons on View Stored Data Screen

Touch **OK** to go back to the pH Setup screen from the View Stored Data screen.

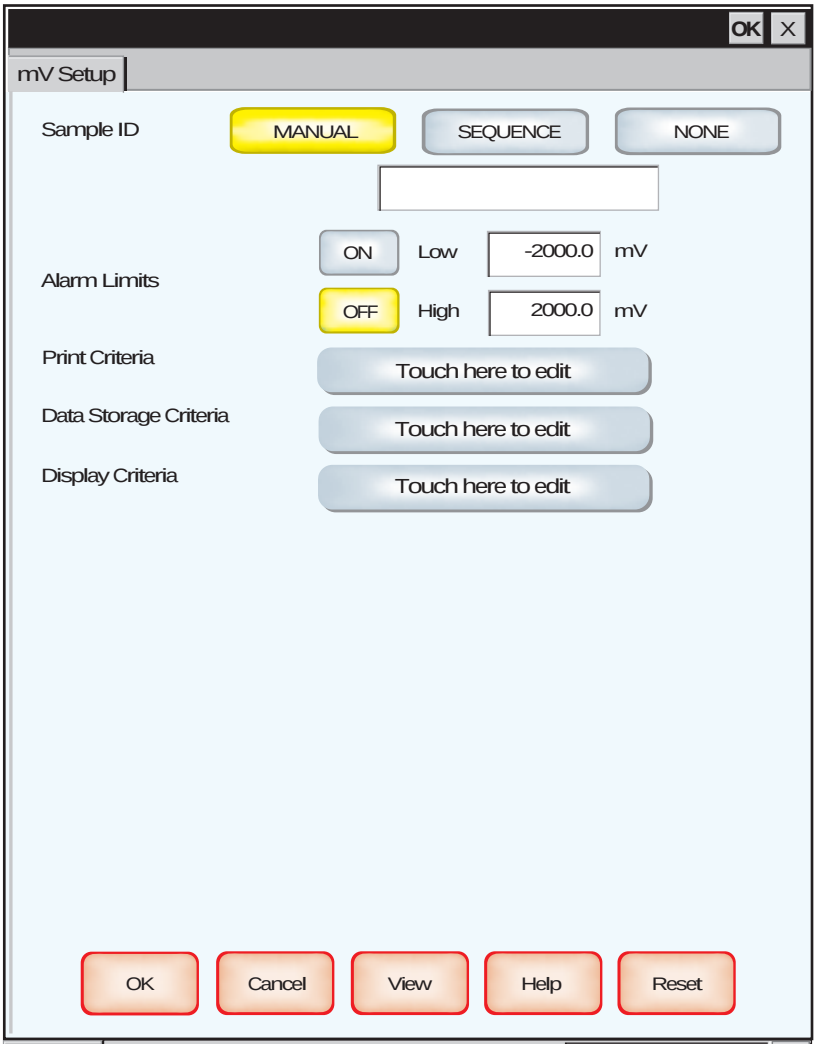
When you touch the **Help** button, information about the current screen appears. This information includes step-by-step instructions for operating the meter from the current screen and possible applications information for that screen.

Touch **Delete** to delete a selected data point from the list. To delete a data point, first touch the data point you want to delete then touch the **Delete** button.

Touch **Delete All** to delete all the data point in the memory.

Touch **Print** to print all the data points in the memory.

The mV Setup screen present many options to control the operating parameters of the meter. The meter is factory set with regard to these options, and is ready for use under most circumstances (see appendix page 59 for default settings). The operating parameters of the mV mode can be set and controlled from the mV setup screen. The mV Setup section will guide you through the various options available in the mV setup mode.



Function buttons on mV Setup Screen

Touch **OK** to confirm mV Setup and return to the mV Measure screen.

Touch **Cancel** to exit and return to the mV Measure screen without confirming mV Setup.

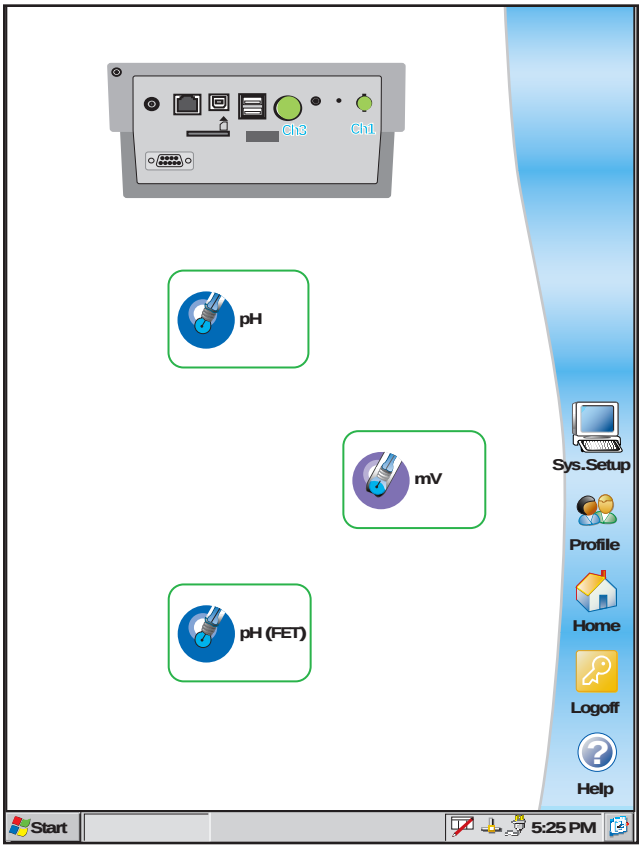
Touch **View** to view all mV data points stored in memory. See pages 41-42 for details.

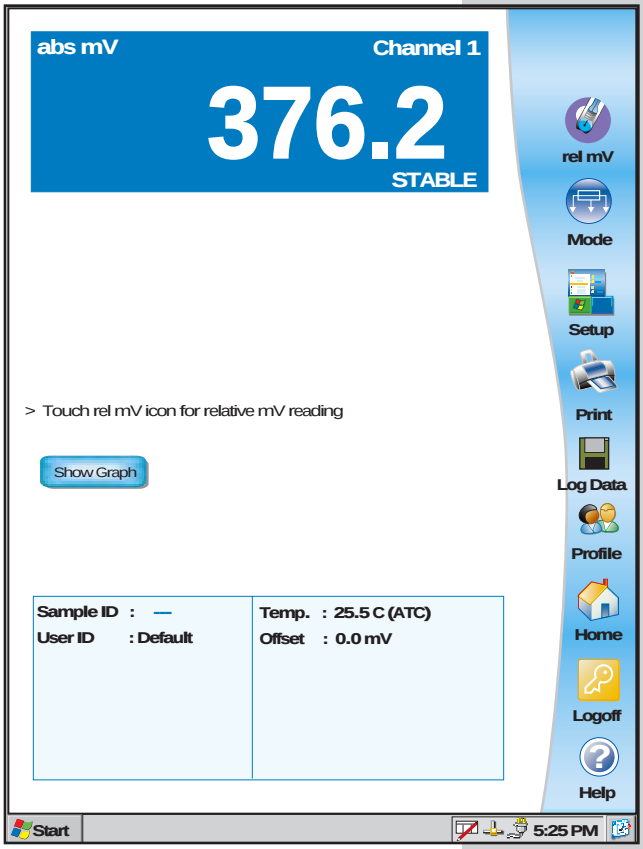
When you touch the **Help** button, information about the current screen appears. This information includes step-by-step instructions for operating the meter from the current screen and possible applications information for that screen.

Touch **Reset** to reset all mV Setup Criteria to the factory default.

There is one way to access the mV Setup screen.

1. Make sure meter is in mV Measure mode. Touch **mV** on the main screen to access the mV mode Measure screen
2. Touch **Setup** option on the mV Measure screen





Whenever this option is active, each time you touch **Print** or **Log Data** on the mV Measure screen, the mV value along with date/time/channel and the sample ID will be sent to data storage. You can manually enter an alphanumeric identification number of 10 characters for any sample or you can have the meter sequentially number your samples beginning at the number of your choice. You can also choose to deactivate the sample ID.

To set sample ID — Manual:

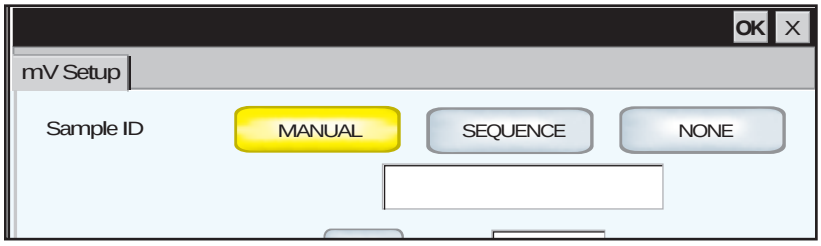
1. Touch **Manual** for manual Sample ID entry.
2. The current ID is displayed on the screen.
3. Use the alphanumeric keypad on the screen to enter the desired Sample ID. The **BS** key will allow you to backspace to remove a character that was incorrectly entered.
4. Touch **Enter** to accept current Sample ID and return to the mV Setup screen.

To set sample ID — Sequential

1. Touch **Sequential** for sequential Sample ID entry
2. The current ID is displayed on the screen
3. Use the numeric keypad on the screen to enter the desired Sample ID number that you would like your sequential Sample ID assignment to begin with. Every time you touch **Print** or **Log Data** on the pH Measure screen, the Sample ID will increase by 1. The **BS** key will allow you to backspace to remove a character that was incorrectly entered.
4. Touch **Enter** to accept the first sequential Sample ID and return to the mV Setup screen.

To deactivate the sample ID assignment — None

1. Touch **None** to deactivate the sample ID assignment

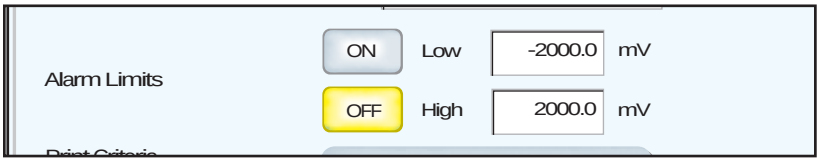


This option allows you to set alarm limits for the mV measuring mode. If the mV value of the measurement is outside of the boundaries set by the minimum and maximum limits, a visual warning will appear to let you know that your sample measurement was outside of the set limits.

The Alarm Limit can be set from -2000.0 mV to 2000.0 mV

To set Alarm Limits

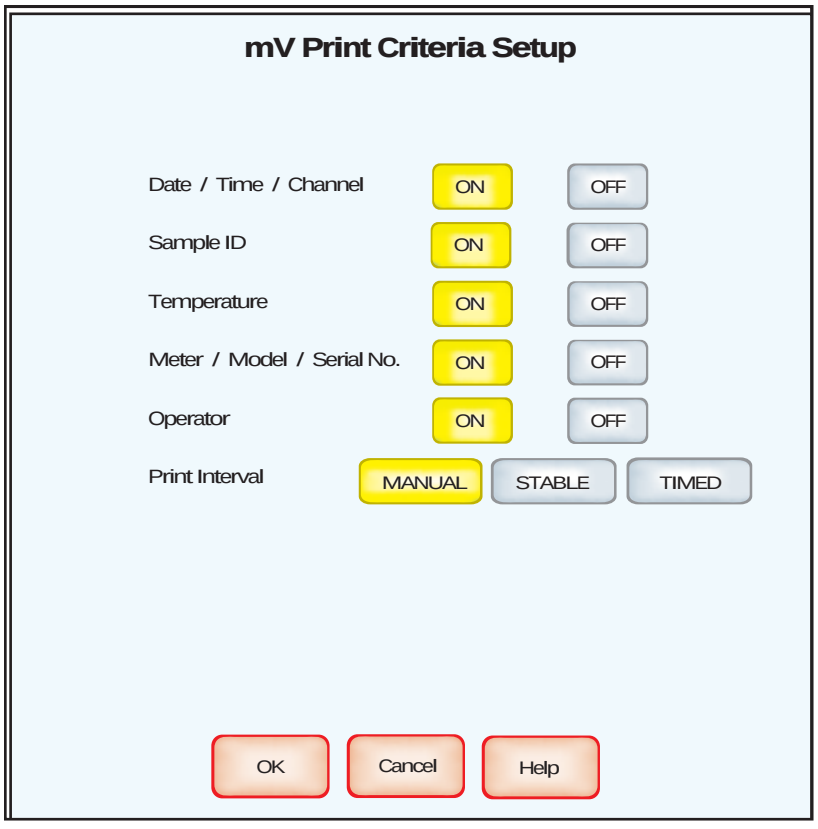
1. Touch **ON** or **OFF** to set the status of the alarm of mV mode
2. Touch the **Low box** and use keypad to enter the new limit values.
3. Touch **Enter** on the keypad to accept this limit and return to the pH mV Setup screen.
4. Touch the **High box** and use keypad to enter the new limit values.
5. Touch **Enter** on the keypad to accept this limit and return to the mV Setup screen.



This screen allows you to select which criteria are printed with the measurement when you print the data or send it to a computer. The status of the current print criteria is displayed on the screen. The criteria option is active if ***ON*** appears to the right of the option. It is inactive if ***OFF*** appears to the right of the option. Any active criteria will be printed on demand.

To set Print Criteria

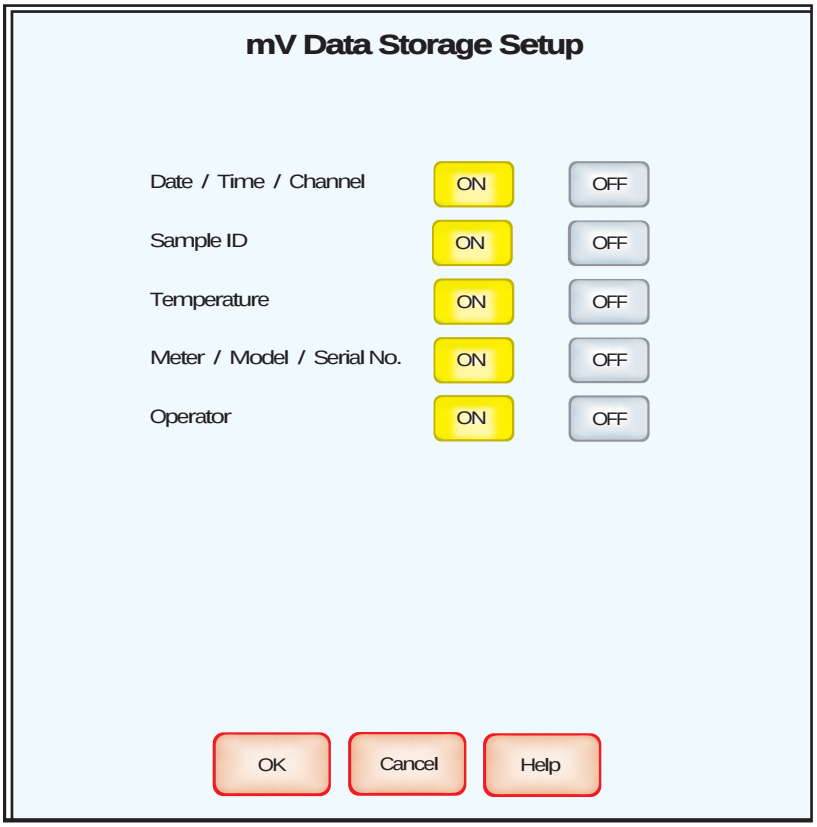
1. Touch the **Touch here to edit** button next to the Print Criteria to access the mV Print Criteria Setup screen.
2. Touch **ON** or **OFF** to change the status of a criteria you want to modify.
3. Repeat step **2** for all the remaining criteria except **Print Interval**.
4. For Print Interval, touch **MANUAL** to print mV data only when the **Print** button is pushed, touch **STABLE** to automatically print mV data when mV reading is stable, or touch **TIMED** to set a specific timed interval in seconds to print mV data.
5. Touch **OK** button to accept the changes of the entire group of print criteria and return to the mV Setup screen.



This screen allows you to select which criteria are stored in the data logger with the measurement when you store the data .The status of the current data storage criteria is displayed on the screen. The criteria option is active if ***ON*** appears to the right of the option. It is inactive if ***OFF*** appears to the right of the option. Any active criteria will be stored on demand.

To set Data Storage Criteria

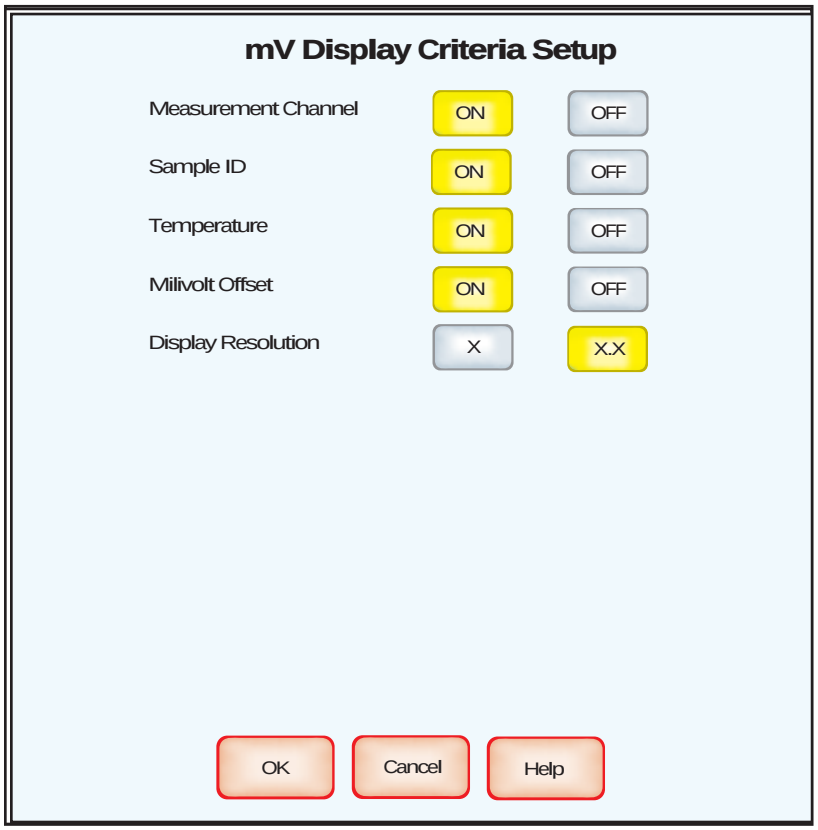
1. Touch the **Touch here to edit** button next to the Data Storage Criteria to access the mV Data Storage Setup screen.
2. Touch **ON** or **OFF** to change the status of a criteria you want to modify.
3. Repeat step **1** for all the remaining criteria.
4. Touch **OK** button to accept the changes of the entire group of data storage criteria and return to the mV Setup screen.



This screen allows you to choose what information you would like to be displayed on the mV Measure screen, particularly the information contained in the data box at the bottom of the Measurement screen. The status of the current display criteria is displayed on the screen. The criteria option is active if ***ON*** appears to the right of the option. It is inactive if ***OFF*** appears to the right of the option.

To set Display Criteria

1. Touch the **Touch here to edit** button next to the Display Criteria to access the mV Display Criteria Setup screen.
2. Touch **ON** or **OFF** to change the status of a criteria you want to modify.
3. Repeat step **2** for all the remaining criteria except **Display Resolution**.
4. For Display Resolution, touch **X** to display mV with one decimal place or touch **X.X** to display mV with two decimal places.
3. Touch **OK** button to accept the changes of the entire group of display criteria and return to the mV Setup screen.



The XL15 has a memory capacity to store up to 1000 data points. The View Stored Data screen allows you to sort and look at specific data points stored in the meter based on the meters memory capacity. The stored data can be sorted by any of the parameters available in the screen header.

The meter stores mV data under the following parameters:

Reading

Operator

Date / Time / Channel

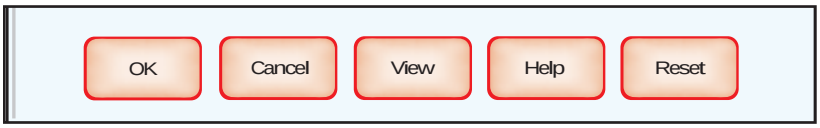
Sample Id

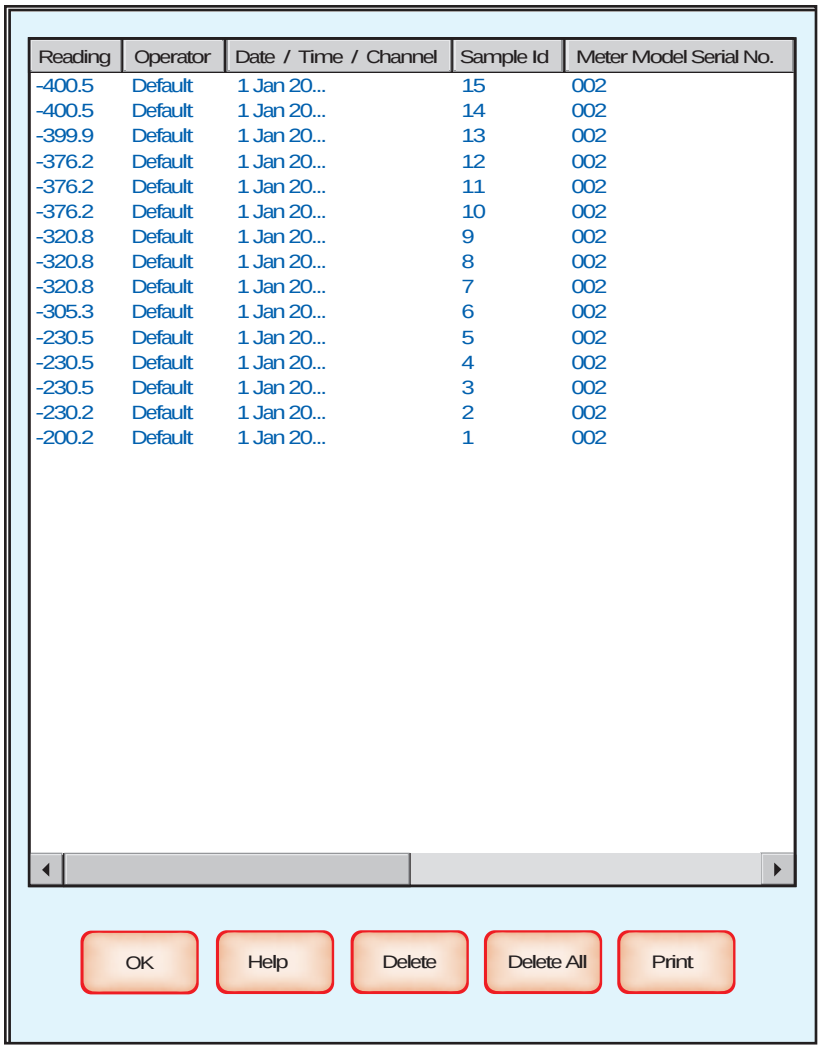
Meter Model Serial No.

To View Stored Data

1. Touch the **View** button in the mV Setup screen

You can only log 1000 data points at a time. To clear space for new data points, you have to delete the same number of old data points as you want to add new data points.




Reading
Operator
Date / Time / Channel
Sample Id
Meter Model Serial No.
-400.5 Default 1 Jan 20... 15 002
-400.5 Default 1 Jan 20... 14 002
-399.9 Default 1 Jan 20... 13 002
-376.2 Default 1 Jan 20... 12 002
-376.2 Default 1 Jan 20... 11 002
-376.2 Default 1 Jan 20... 10 002
-320.8 Default 1 Jan 20... 9 002
-320.8 Default 1 Jan 20... 8 002
-320.8 Default 1 Jan 20... 7 002
-305.3 Default 1 Jan 20... 6 002
-230.5 Default 1 Jan 20... 5 002
-230.5 Default 1 Jan 20... 4 002
-230.5 Default 1 Jan 20... 3 002
-230.2 Default 1 Jan 20... 2 002
-200.2 Default 1 Jan 20... 1 002
OK
Help
Delete
Delete All
Print

Function buttons on View Stored Data Screen

Touch **OK** to go back to the mV Setup screen from the View Stored Data screen.

When you touch the **Help** button, information about the current screen appears. This information includes step-by-step instructions for operating the meter from the current screen and possible applications information for that screen.

Touch **Delete** to delete a selected data point from the list. To delete a data point, first touch the data point you want to delete then touch the **Delete** button.

Touch **Delete All** to delete all the data point in the memory.

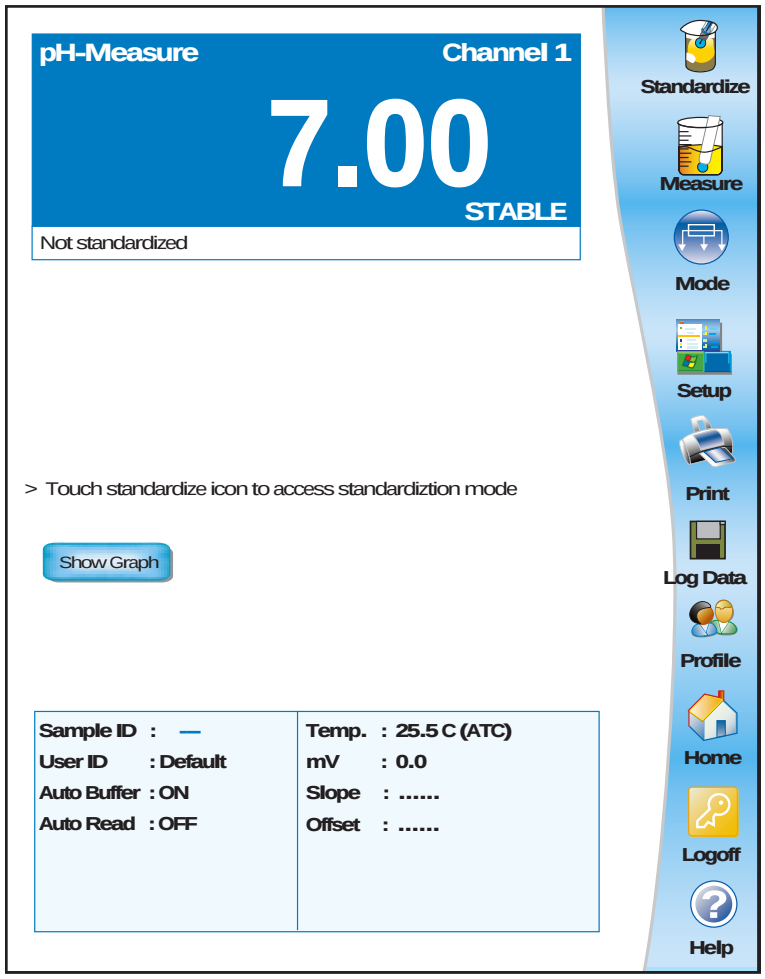
Touch **Print** to print all the data points in the memory.

In this mode, you will able to measure the pH of a wide variety of samples. Before measuring pH, you will need to standardize the meter using buffers with known pH values. It is good practice to standardize the meter frequently using a minimum of two buffers. Using two buffers allows the meter to calculate and display an actual slope for the electrode, and therefore produce more accurate measurements. If there is no standardization in the memory of the meter or if only one buffer has been used to standardize the meter, the slope value will appear as **"....."**.

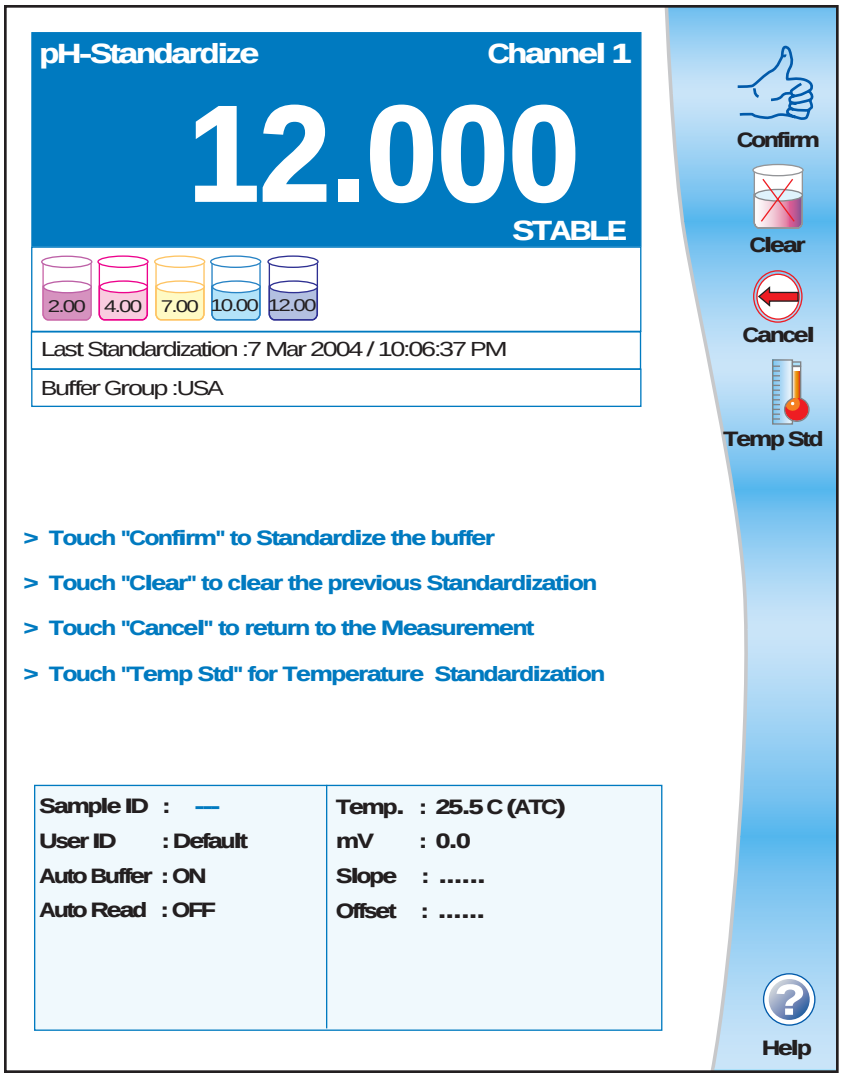
You can standardize your meter using automatic or manual buffer recognition. With the Automatic buffer recognition activated (**ON**), the meter will automatically recognize the buffers from the chosen buffer group and flash the current buffer. When the reading is stable, you must confirm the buffer. In the Manual buffer recognition mode, you must enter the buffer value during the standardization procedure. The meter will flash the manually entered buffer you must confirm the buffer when the reading is stable. During the standardization procedure, you may accept the buffer value before the meter recognizes it as stable by touching confirm. See page 23 to select desired buffer recognition.

Remember to setup your pH measuring mode parameters. Refer pages 19-33 for pH Setup section for instructions.

Connect the electrodes you will be using to the meter.



pH measure screen without standardization

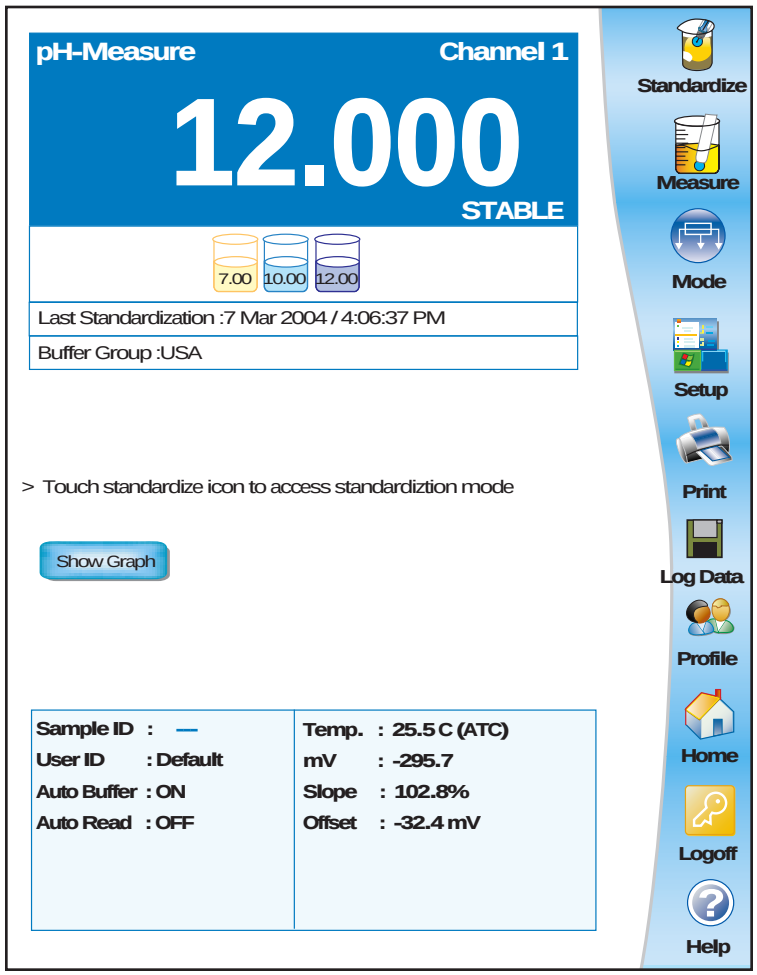

pH-Standardize
Channel 1
12.000
STABLE
2.00
4.00
7.00
10.00
12.00
Last Standardization :7 Mar 2004 / 10:06:37 PM
Buffer Group :USA
Confirm
Clear
Cancel
Temp Std
Help
> Touch "Confirm" to Standardize the buffer
> Touch "Clear" to clear the previous Standardization
> Touch "Cancel" to return to the Measurement
> Touch "Temp Std" for Temperature Standardization
Sample ID : —
User ID : Default
Auto Buffer : ON
Auto Read : OFF
Temp. : 25.5 C (ATC)
mV : 0.0
Slope : .....
Offset : .....

To Standardize the meter with Auto Buffer Recognition

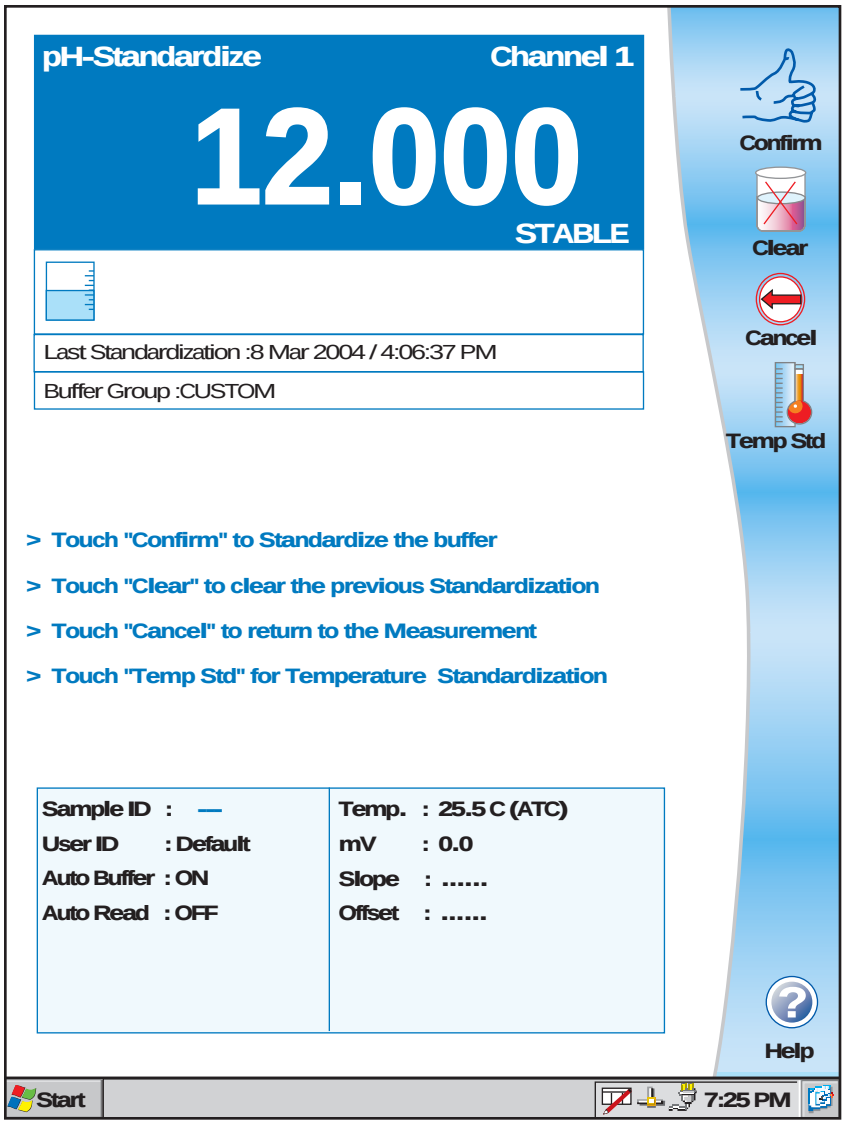
1. Touch **Standardize** on the pH measure screen to access the standardized screen.
2. If the screen says **"Not standardized"** proceed to step **4**.
3. Touch **Clear** to delete all previous standardization values.
4. Immerse your rinsed electrode(s) and temperature probe in a buffer solution from the selected buffer group that you chose during the pH setup process and stir gently. The selected buffer group appears on the standardization screen.
5. The screen will flash a beaker icon of the buffer solution you have selected. When the reading is stable, **STABLE** appears on the screen. Touch **Confirm** to standardize the buffer. The meter will then return to the pH measure screen.
6. Touch **Standardize** on the pH measure screen to access the standardization screen and repeat steps **4** through **6** to standardize with up to 5 buffers.

The efficiency of the electrode is reported as the slope. When doing a multi-point standardization, the slopes of the individual segment are calculated by the meter. The slope that appears on the screen is the slope that is the least perfect, or the farthest from 100%.

For optimal results, the meter should be standardized at a minimum of every 8 hours. For more accurate measurements, the meter should be standardized more frequently.

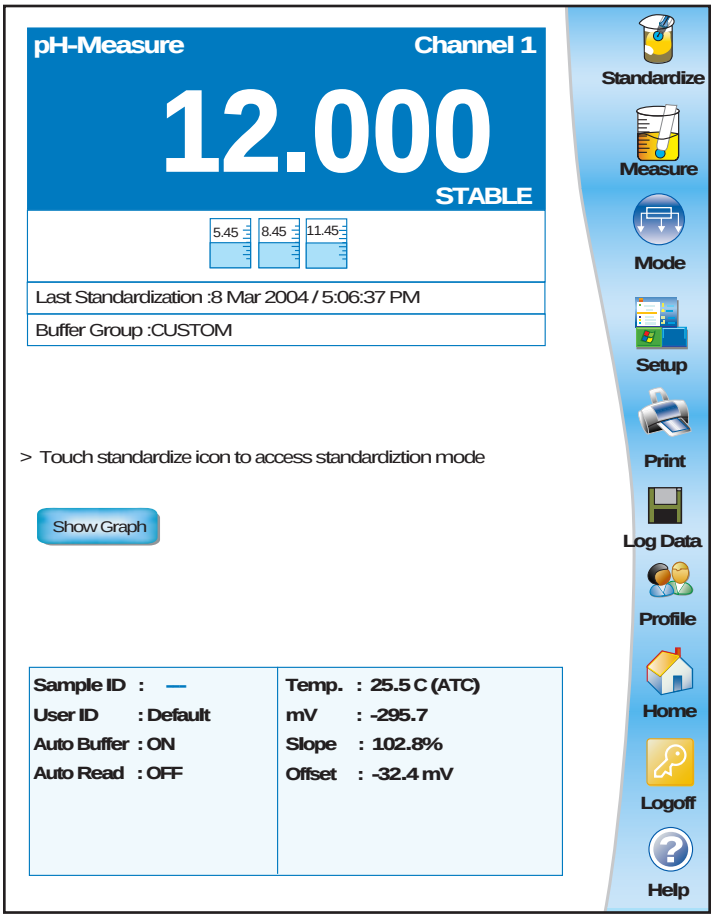


Once meter is calibrated pH Measure screen shows the buffers that have been standardized and the time/date of last standardization.


pH-Standardize
Channel 1
12.000
STABLE
Last Standardization :8 Mar 2004 / 4:06:37 PM
Buffer Group :CUSTOM
Confirm
Clear
Cancel
Temp Std
> Touch "Confirm" to Standardize the buffer
> Touch "Clear" to clear the previous Standardization
> Touch "Cancel" to return to the Measurement
> Touch "Temp Std" for Temperature Standardization
Sample ID : —
User ID : Default
Auto Buffer : ON
Auto Read : OFF
Temp. : 25.5 C (ATC)
mV : 0.0
Slope : .....
Offset : .....
Help
Start
7:25 PM

To standardize the meter with Manual Buffer Recognition

1. Touch **Standardize** on the pH measure screen to access the standardized screen.
2. If the screen says **"Not standardized"** proceed to step **4**.
3. Touch **Clear** to delete all previous standardization values.
4. Immerse your rinsed electrode(s) in a buffer solution and stir gently.
5. The screen will flash each beaker icon once, then a number keypad will appear. Using the displayed keypad input the value of the buffer that you are using to standardize the meter and then touch **Enter**. The meter now shows the buffer value in the flashing beaker.
6. When the reading is stable, **STABLE** appears on the screen. Touch **Confirm** to standardize the buffer. The meter will then return to the pH measure screen.
7. Touch **Standardize** on the pH measure screen to access the standardization screen and repeat steps **4** through **7** to standardize with up to 5 buffers.



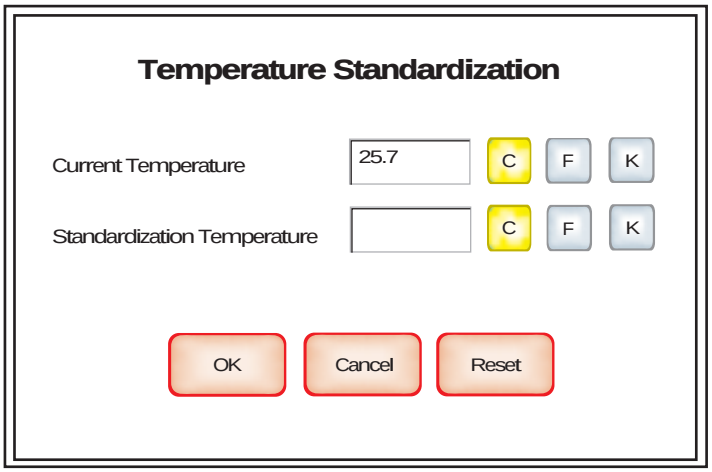
Once meter is calibrated pH Measure screen shows the buffers that have been standardized and the time/date of last standardization.

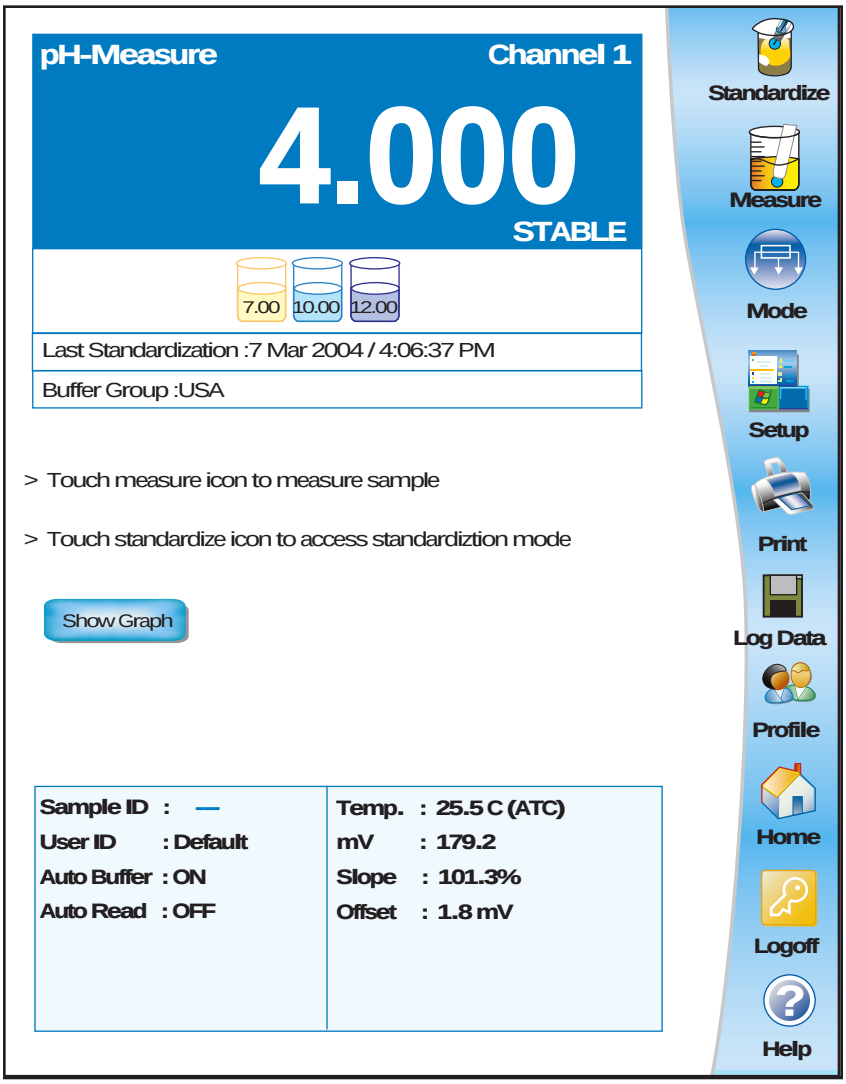
To Standardize Temperature of the Meter

1. Touch **Standardize** on the pH measure screen to access the standardized screen.
2. Make sure ATC probe is attached to meter.
3. Immerse your ATC probe into a solution of known temperature, such as a temperature bath, for a few minutes while temperature stabilizes.

4. Touch **Temp Std** to access temperature standardization
5. The Temperature Standardization screen appears. Check the current temperature displayed with that of the solution of known temperature. Touch the **Standardization Temperature** box and use numeric keypad to enter the current temperature. Press **Enter** to confirm value.
6. Touch **OK** to confirm Standardization Temperature and return to the pH Measure screen. Touch **Reset** to reset and enter a new standardization temperature. Touch **Cancel** to cancel temperature standardization and return to the pH Standardization screen.

Note: The meter will not allow entered value to exceed ±5° of the ATC probe value. If entered value exceeds ±5° an error window will appear and you will have to re-enter value or cancel out of the temperature screen. This might indicate that you have a faulty ATC probe.





pH Measure screen with Auto Read ON

The measure screen provides readout of the current sample measurement. You can use this meter when the Auto Read function is active or when it is inactive. When the auto read function is active, the meter will lock onto a reading when the meter recognizes it as stable. The meter will not deviate from this reading until the Measure button is touched. If the Auto Read mode is inactive, then the meter will continuously monitor the pH of the sample and the measure display screen will indicate any fluctuation in the sample pH. Regardless of the status of the Auto Read mode, **STABLE** will flash as the meter recognizes the measurement as stable.

Once the meter is standardized, you are ready to take pH measurements of your sample.

To Measure pH of a Sample with Auto Read ON

1. Immerse the rinsed electrode(s) in the sample and stir gently.
2. Touch **Measure** to begin measuring your sample. The meter will accept the reading and display **STABLE** when the measurement meets the selected stability criteria.

OR

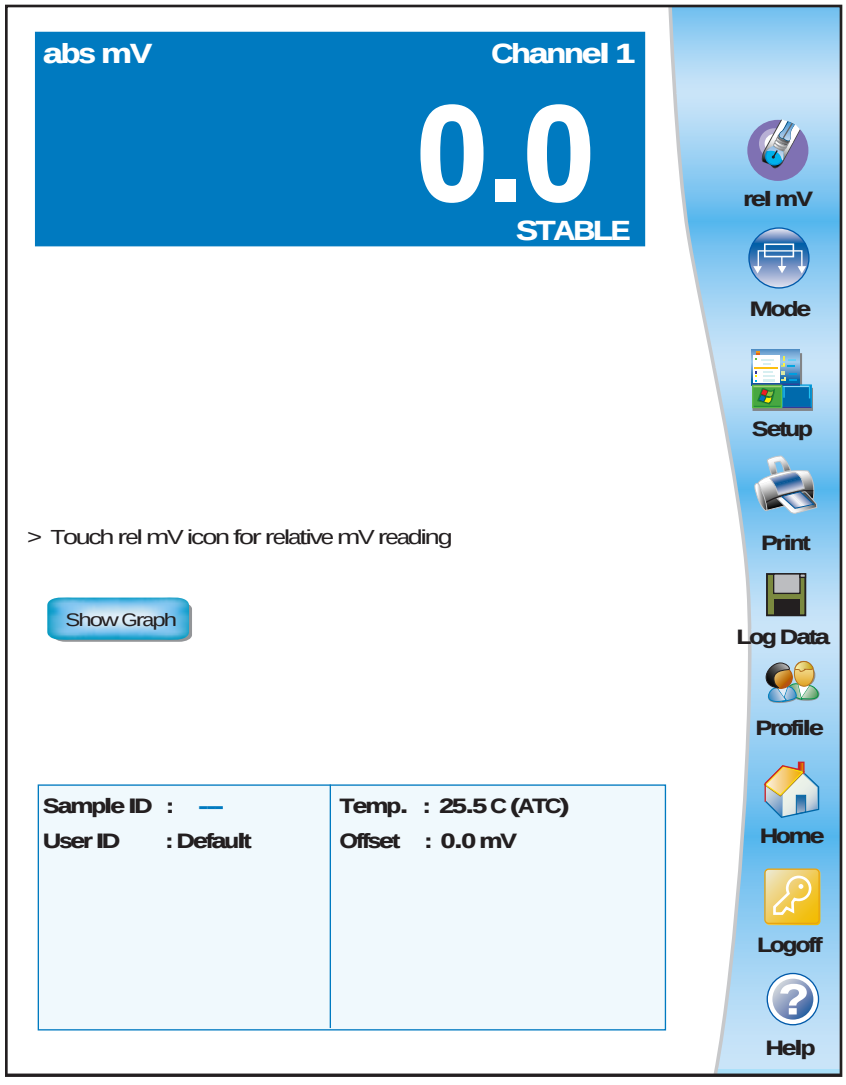
To Measure pH of a Sample with Auto Read OFF

1. Immerse the rinsed electrode(s) in the sample and stir gently.
2. Record the reading once the measurement has become stable. **STABLE** will appear once the meter recognizes that the measurement is stable.

NOTES: You can access other functions of the meter with the remaining buttons on the measure screen.

- Touching **Print** will send the data to the meter's memory if the sample ID# is activated and to a printer or a computer if it is attached to the meter. The saved data can be accessed through the View Storage Data screen in the pH Setup mode.
- Touching **Setup** will access the pH Setup screen.
- Touching **Measure** will initiate a new measurement of a sample with Auto Read ON.
- At anytime, you can touch **Mode** to access another mode of operation including: mV, rel mV or the setup mode.

This mode is used to measure oxidation/ reduction potential (ORP/redox), perform titration and to verify the function of the meter.The mV measure function allows you to continuously monitor the mV potential of the electrodes in use. This can be done in either absolute or relative mV. In the millivolts mode, the current millivolt output from the electrodes being used is monitored and displayed on the screen. The meter will continually monitor the millivolts reading in this mode and will not lock onto a single reading. However, once the reading has become stable, a **STABLE** will be displayed. Remember to setup your mV measuring mode parameter, see pages 34-42 for mV Setup section.



In the mV mode, you will be able to make measurements in either absolute or relative millivolts, access the mV Setup screens and print your results to a printer or a computer.

Connect the electrodes you will be using to the meter. See page 6 for details.

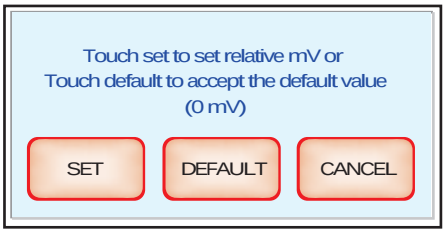
Absolute mV Measurements

1. Access the mV measure screen from the main screen
2. Touch **abs mV** to access the Absolute mV screen.
3. Immerse the rinsed electrode(s) in the sample and stir gently.
4. Record the measurement when **STABLE** is displayed.
5. Touch **Print** to store a measurement with an assigned ID# in the data storage center of the meter or print the data to a printer or computer.

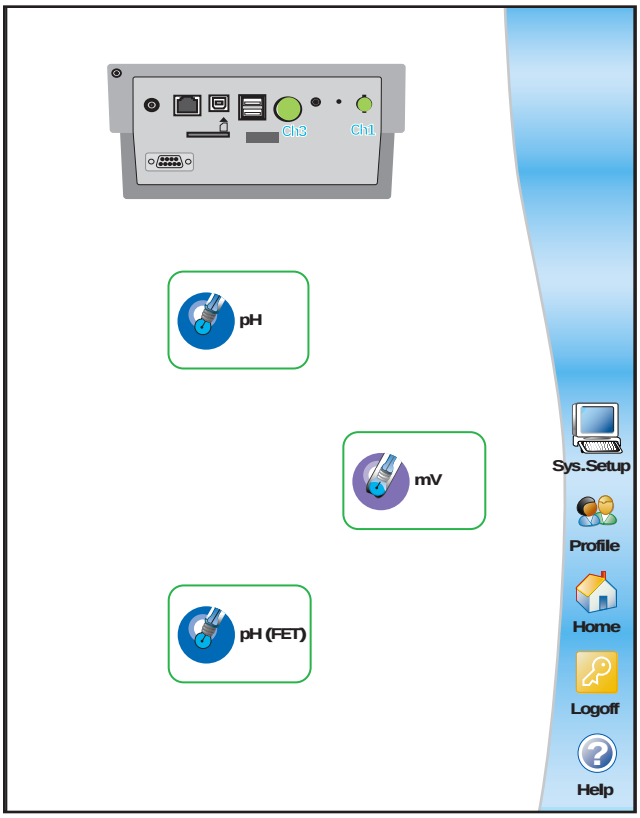
Relative mV Standardization and Measurement

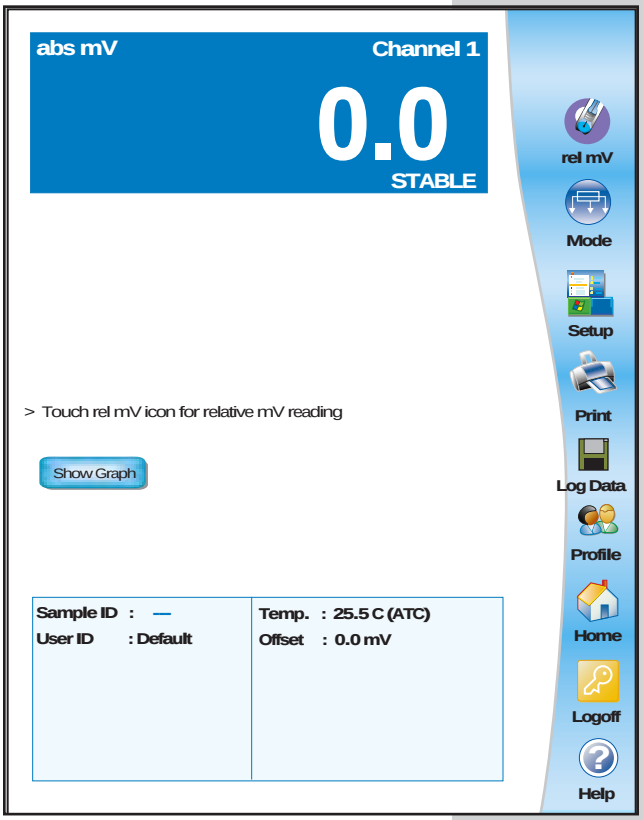
In the relative mV mode, we have an option either to adjust the displayed value within a ±150 mV window or equate it to zero.

1. Access the mV Measure screen from the main screen.
2. Immerse the rinsed electrode(s) in the mV (ORP) standard solution and wait for **STABLE** to appear.
3. Touch **rel mV** to access the Relative mV screen. When **rel mV** is touched, a dialog box appears.
4. Touch **SET** to set relative mV using numeric keypad and press **Enter** to confirm value.
   OR
   Touch **DEFAULT** to accept the default value (0 mV)
   OR
   Touch **CANCEL** to cancel and return to previous screen.
5. The meter is now ready to take relative mV measurements. Touch **Print** to store a measurement with an assigned ID# in the data storage center of the meter or print the data to a printer or computer.



Rinse the electrode with water and blot dry. Do not wipe the electrode. Wiping the electrode can cause a static charge on the glass bulb that will result in inaccurate readings.


Ch3
Ch1
pH
mV
pH (FET)
Sys.Setup
Profile
Home
Logoff
Help


abs mV
Channel 1
0.0
STABLE
rel mV
Mode
Setup
Print
Log Data
Profile
Home
Logoff
Help
> Touch rel mV icon for relative mV reading
Show Graph
Sample ID : —
User ID : Default
Temp. : 25.5 C (ATC)
Offset : 0.0 mV

The touch screen should be kept as clean as possible to preserve optical properties. Attempt to keep the screen free of dirt, dust fingerprints, etc .Long term contact with abrasive materials will scratch the surface, and impair image quality. To clean, use a damp nonabrasive cloth towel and any commercially available window cleaner. The cleaning solution should be applied to the towel rather than the surface of the touch screen.

The case is made out of durable ABS plastic. It can be cleaned with a damp cloth and a mild detergent. Do not use chemical solvents on the case.

Your XL15 meter contains many error messages to provide aid should trouble occur with a measurement or meter operation (touch pad and input errors). The messages are accompanied by a brief description of the error, and in some cases advice on how to correct it. An example of an error message is:

Bad Electrode Slope-The electrode you have standardized has a slope which is out of the normally acceptable range of 90% to 102%. You should try to restandardize, or replace your electrode if the problem persists. Note that you can continue to make measurements with this electrode; however, the readings may be inaccurate.

Also, whenever possible, touch **Help** for complete information about the meter operation in which you are currently engaged.

pH Meter and Electrode Warranty Statement

The Fisher Scientific Company (“Fisher”) warrants to the direct purchaser that the accumet meters and Accumet, AccuTupH, AccuFET, AccupHast, and Microprobe electrodes will be free from defects in material or workmanship for a specified warranty period. During that period, Fisher will repair or replace the product or provide credit, at its sole option, upon prompt notification and compliance with its instructions. For accumet meters, that specified period is 24 months from delivery date. For electrodes, that specified period is 12 months - except for models 13-620-532, 13-620-533, 13-620-534, 13-620-535, 13-620-536, 13-620-537, 13-620-538 and 13-620-539 - which are warranted for six months.

Unless otherwise agreed, the warranty is limited to the country in which the product is sold.

No Fisher employee, agent or representative has the authority to bind Fisher to any oral representation or warranty concerning any product sold. Any oral representation or warranty made prior to purchase of any product and not set forth in writing and signed by a duly authorized officer of Fisher shall not be enforceable by the purchaser.

FISHER EXPRESSLY DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING THE IMPLIED WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Fisher’s sole responsibility and the purchaser’s exclusive remedy for any claim arising out of the purchase of any product listed above is repair, replacement or credit as described above, where applicable. In no event: 1) shall the cost of the exclusive remedy exceed the purchase price: 2) shall Fisher be liable for any special, indirect, incidental, consequential, or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

Each article that Fisher furnishes will conform to the written specifications given in this manual, or those of a further improved model. Changes are made often to the information in the manual and will be incorporated into future editions.

Notice of Compliance

WARNING: This meter generates, uses, and can radiate radio frequency energy. If not installed and used properly, that is in strict accordance with the manufacturer's instructions, it may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area may cause interference, in which case the user, at his own expense, will be required to take whatever measures may be required to correct the interference.

This product is to be used only as described in the manual. This product is for indoor use only, and must be used in a well ventilated area.

WARNING: To meet or exceed FCC regulations and comply with CE requirements, the Fisher-supplied power supply must be used. Use of a power supply that is not approved by Fisher Scientific may cause safety hazards and/or cause unit to exceed EMC limits and/or damage unit. When using this meter with a computer or printer, a shielded RS232 cable must be used to meet or exceed FCC regulations, and comply with CE Mark requirements.

The isopotential point of an electrode system is the point at which electrode potential is unaffected by a change in temperature. The coordinates of this point would be reported as (pX_{iso} , Eis_0). For an ideal system, this point would be coincident with the system's Zero Potential Point (pX_{iso} , E_0).

In practical systems, however, this coincidence rarely occurs, and for some systems, there is no true Isopotential Point but a general Isopotential area. If a system exhibits an apparent Isopotential Point, or at least an Isopotential area with relatively small spread, Isopotential coordinates may be established and possibly used to some advantage. Isopotential correction may be used only in conjunction with a One- or Two- Point Standardization; it is required only when both accuracy over a significant temperature range as well as operation with an asymmetric electrode system are contemplated. However, Isopotential correction is never necessary if all measurements will be performed on samples which are at similar temperatures. Most conventional pH electrode systems are designed and manufactured to be highly symmetrical cells. Consequently, for most pH work, unless ultimate accuracy over broad temperature ranges is required, Isopotential may be ignored. Specifically, this is accomplished by setting the Isopotential at its reset value of zero millivolts.

The following is an example for determining an Isopotential Point:

Data points are first established for three different standards at three different temperatures. The data points are then plotted and will produce three isotherms which should resemble the plot in either figure 1 or figure 2. In figure 2, the Isopotential Point is well defined as the intersection point of the three Isotherms (pX_{iso} , E_{iso}). The Isopotential Point is not so well defined in figure 1, but a value may be interpolated with some accepted error.

Figure 1

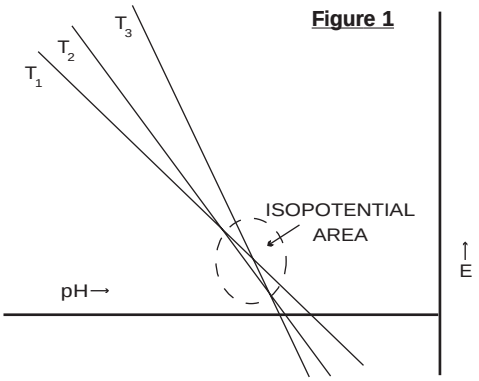
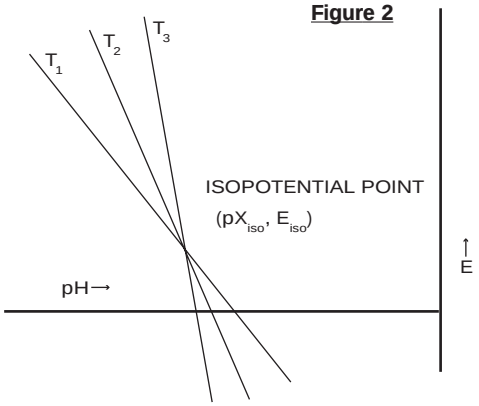


Figure 2



The following is the list of factory default settings for the XL15 meter. You can reset your meter to the factory default settings by accessing the Reset to Factory Defaults from the System Setup screen

Screen	Default Setting
pH Setup Mode	
Display configuration	All parameters ON
Print configuration	All parameters ON
Data configuration	All parameters ON
Buffer Group	USA
Sample ID#	None
Isopotential Point	0 mV
Print interval	manual
Display resolution	X.XX
Auto Buffer Recognition	ON
Auto Read Mode	OFF
Temperature Units	Celsius
Default Temperature	25 degree Celsius
Stability Criteria	Fast
Default Slope	Not Applicable
alarm limits	OFF
alarm limit low	-2 pH
alarm limit high	20 pH
mV Setup Mode	
Display configuration	All parameters ON
Print configuration	All parameters ON
Data configuration	All parameters ON
Sample ID#	None
Print interval	Manual
Display resolution	X
mV Readings	Absolute mV
alarm limits	OFF
alarm limit low	-2000 mV
alarm limit high	+2000 mV

Since its introduction by the Danish chemist Sorensen in 1909, pH measurement has become one of the most commonly used and important measurements in both laboratory and industrial settings. pH measurement and control is vital to a wide array of endeavors including municipal and industrial wastewater treatment, and textile, pharmaceutical, food, and petroleum production. Even our very existence itself is dependent upon pH. Most organisms can exist only within a narrow pH range. In humans, for example, the pH of blood must be maintained within the pH range of 7.3 to 7.4 .

In general, pH is a measure of the degree of acidity or alkalinity of a substance. It is related to the effective acid concentration ("activity") of a solution by this defining equation:

$$pH = -\log aH_3O^+$$

with a H_3O^+ representing the activity or effective concentration of the hydronium ion in solution.

Analysts traditionally work with concentration units rather than activity. Therefore neglecting activity, pH can be defined by the following equation:

$$pH = -\log [H_3O^+]$$

with $[H_3O^+]$ representing the concentration in Moles/liter of the hydronium ion in solution.

The pH range includes values from 0 to 14. Values from 0 to 7 represent the acidic half of the scale. Values from 7 to 14 represent the alkaline or basic half of the scale. The pH value 7 is considered neutral, as it is neither acidic or alkaline.

The pH scale is based on the dissociation constant of water. Water, even in its purest state, dissociates as follows producing a positively charged hydronium ion (H_3O^+) and a negatively charged hydroxyl ion (OH^-):

$$2H_2O = H_3O^+ + OH^-$$

At 25°C in pure water, the concentration of hydronium ions is extremely small, 1 x 10^{-7} Moles/liter, and balanced by an equal concentration of hydroxyl ions. The equilibrium constant, Kw of water is the product of the hydronium ion and hydroxyl ion concentrations:

$$Kw = [H_3O^+]\,[OH^-] = [1x10^{-}7]\,[1x10^{-7}] = 1x10^{-14}$$

Since the hydronium ion concentration is 1 x 10^{-7} Moles/liter, the pH of pure water is 7 , the neutral pH, as stated above:

$$pH = -\log [1 \times 10^{-7}] = 7$$

In aqueous solutions at 25°C, the product $[H_3O^+]\,[OH^-]$ or the Kw of water must remain constant. Therefore, an increase in concentration of either term, $[H_3O^+]$ or $[OH^-]$, will result in a decrease in the other. For example, if a strong base, sodium hydroxide (NaOH) is added to water to the extent that its final concentration is 0.01 Moles/liter, the concentration of the OH^- ion is 0.01 Moles/liter, and the concentration of the H_3O^+ must decrease according to the Kw equation as follows:

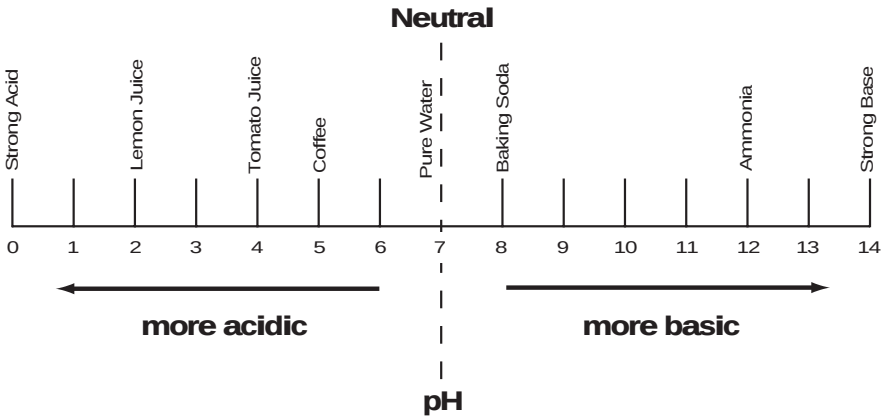
$$[H_3O^+] = Kw/\,[OH^-] = 1 \times 10^{-14} / 1 \times 10^{-2} = 1 \times 10^{-12}$$

The pH of this solution is:

$$pH = -\log [1 \times 10^{-12}] = 12$$

This high pH indicates that the 0.01 M NaOH solution is strongly alkaline; the concentration of hydronium ions is extremely small.

Figure 1



pH Measurement

The pH value of a sample can be determined in several ways. These include the use of organic dyes which change color in certain pH ranges. The dyes can be added directly to the solution or impregnated onto paper which may be dipped into the solution. At best, these "colorimetric" methods yield approximate pH values, often with an accuracy of plus or minus 0.5 pH units.

The preferred and most accurate way to measure a pH value is the potentiometric measurement, using a pH electrode, a reference electrode, and a pH meter. This method is based on the fact that certain electrodes, immersed in solution, produce a millivolt potential (i.e. voltage) that is related to the hydronium ion concentration or pH of a solution in a precise way.

The relationship between the electrode's voltage and the solution pH is defined by the Nernst equation:

$$E_{meas} = E^* - \left(\frac{2.3RT}{nF}\right)(pH)$$

In this equation, Emeas is the voltage output of the electrodes, E* is the total of all other voltages in the system including the reference voltage, R is the Gas Law constant, T is the temperature in °Kelvin, n is the charge on the hydronium ion (+1), and F is the Faraday constant.

pH Meter

The pH meter is a sensitive voltmeter capable of accurately measuring small voltage differences between the pH electrode and the reference electrode. This voltage difference is amplified, and shown as a pH reading. Almost all modern meters are microprocessor controlled, and programmed to use electrode voltages, efficiency, and temperature to calculate an accurate pH for the sample. Since the voltage output from different electrodes will vary, it is essential to calibrate a pH meter. The ability to calibrate or to standardize a pH meter permits the meter to match the pH reading on the meter with the known pH value of a buffer solution. For best accuracy, it is recommended that at least two buffer solutions be used to calibrate a pH meter. Buffer solutions are available as ready-to-use solutions, concentrated solutions, capsules, or prepackaged salts. The following table lists three of the most widely used NIST buffers along with their pH values at different temperatures.

Temperature	4.01	6.86	9.18
0	4.003	6.984	9.464
10	3.998	6.923	9.332
20	4.002	6.881	9.225
25	4.008	6.865	9.180
30	4.015	6.853	9.139
40	4.035	6.838	9.068
50	4.060	6.833	9.011

pH Electrodes

The electrode system consists of two half cells: a pH indicating electrode, which is primarily responsive to the acidity (the hydronium ion concentration-tion) of a solution, and a reference electrode, which provides a constant voltage and completes the electrical circuit.

Traditional pH indicating electrodes use a tip made of pH sensitive glass. Inside this electrode is a buffer solution with a fixed pH and ionic strength. A silver wire coated with silver chloride is immersed inside this internal solution, and establishes electrical contact between the solution and the meter. The voltage associated with this wire and the voltage associated with the pH of the internal solution and the inside wall of the pH sensitive glass tip remain constant. Therefore, changes in voltage from this electrode result from the voltage developed between the solution and the outside of the glass tip.

If the pH sensitive glass tip or membrane is to function properly, it must be hydrated. A dry or dehydrated electrode membrane will not respond properly to changes in acidity. pH electrodes are also effected by changes in temperature, and the presence of other ions. Temperature effects can be countered by temperature compensation functions on the pH meter. While temperature compensation will not allow you to predict what the pH of the sample is at another temperature, it will permit you to accurately assess the pH at whatever temperature you are presently working. pH sensitive membranes are also sensitive, though to a lesser extent, to other ions than the hydronium ion. For example, most pH glasses are somewhat sensitive to sodium ion as well. For some pH glasses, this means an error as high as 0.5 pH units in highly alkaline, high-sodium solutions. The special FS-5 glass used in Fisher's pH electrodes exhibits much less sodium error in these solutions, <.05 pH units.

Reference electrodes typically consist of three elements: an internal reference electrode, a filling solution, and a reference junction through which the filling solution can "flow", and provide electrical contact with the sample and the internal reference electrode. The most convenient internal reference electrodes are made from a metal (such as silver or mercury) and its sparingly soluble salt (silver chloride or mercurous chloride). The filling solution is most often a concentrated solution of potassium chloride. Most problems with reference electrodes are associated with the interruption or blockage of flow of the potassium chloride fill solution through the reference junction.

The classic electrode pair, separate pH indicating and reference half cells, offer you unmatched versatility to match the needs of your sample. This approach makes for the highest accuracy, as well as low replacement costs, since usually only one of the pair is broken or malfunctioning.

However, the pH indicating half-cell and the reference half-cell can be merged into one electrode - a combination electrode. Combination electrodes are quite popular for they offer distinct advantages in convenience and compactness. Some combination electrodes also incorporate an ATC probe into their body also, providing temperature readout and compensation with meters equipped with these features. Newer combination electrodes are available in which the glass pH membrane sensor has been replaced with a field effect transistor or FET. All of Fisher Scientific's AB, AR and XL meters are capable of using this type of electrode by direct connection (except AB30).

Replacement Parts

Description	Fisher Catalog Number
Accumet pH combination electrode, single junction, Ag/AgCl reference, glass body, BNC connector	13-620-285
ATC Probe	13-620-19
AccuFlex electrode support arm	13-637-671
Electrode support bracket	13-637-671A
Power Supplies: 115V, US plug	13-636-100
230V, UK plug	13-636-101
230V, Europe plug	13-636-102
Operator's Manual	13-636-AR50M
BNC Shorting cap	13-620-99

Accessories

pH Electrode	Fisher Catalog Number
Accumet pH combination electrode, single junction, calomel reference, glass body, BNC connector.	13-620-286
Accumet 3-in-1 pH/ATC combination electrode, single junction, Ag/AgCl reference, glass body, BNC connector	13-620-530
Accumet 3-in-1 pH/ATC combination electrode, single junction, calomel reference, glass body, BNC connector	13-620-531
AccupHast pH combination electrode, double junction, glass body, BNC connector.	13-620-296
AccupHast pH combination electrode, double junction, epoxy body, BNC connector	13-620-298
AccuFET solid state pH/ATC combination electrode, Ag/AgCl gel reference	13-620-755

pH Buffers and Solutions

pH	Color	Ingredients	Size	Fisher Catalog Number
4.00	Red	Potassium Biphthalate	500 mL	SB101-500
7.00	Yellow	Potassium Phosphate Monobasic & Sodium Hydroxide	500 mL	SB107-500
10.00	Blue	Potassium Carbonate, Potassium Borate & Potassium Hydroxide	500 mL	SB115-500
Fisher Buffer-Pac		(500mL ea. of color coded pH 4, 7, and 10 buffers)	3x500 mL	SB105
4.00	Red	Individual Tear open pH Packets	20/box	SB4
7.00	Yellow	Individual Tear open pH Packets	20/box	SB7
10.00	Blue	Individual Tear open pH Packets	20/box	SB10
	Gray	Electrode Rinse Individual Tear open pH Packets	20/box	SB15
		Electrode Storage Solution	1L S	E40-1

To place an order, call 1-800/766-7000

For a complete selection of electrodes and accessories, please refer to the Fisher 2004/05 Catalog, or contact your Fisher Scientific sales representative.